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# BULLETIN OF THE BRITISH MUSEUM (NATURAL HISTORY)

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BRITISH MUSEUM
-7 DEC 1973
NATURAL HISTORY

# A LIST OF THE TYPE-SPECIMENS OF *PARNASSIUS* (LEPIDOPTERA: PAPILIONIDAE) IN THE BRITISH MUSEUM (NATURAL HISTORY)

P. R. ACKERY

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# A LIST OF THE TYPE-SPECIMENS OF *PARNASSIUS* (LEPIDOPTERA : PAPILIONIDAE) IN THE BRITISH MUSEUM (NATURAL HISTORY)

*By* P. R. ACKERY

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## SYNOPSIS

A list is given of the type-specimens of the 339 nominal species, subspecies and infrasubspecific forms, originally described or subsequently placed in the genera *Eukoramius* Bryk, *Kailasius* Moore, *Koramius* Moore, *Lingamius* Bryk, *Parnassius* Latreille and *Tadumia* Moore, represented by type-material in the British Museum (Natural History). Three lectotypes are newly designated.

## INTRODUCTION

THROUGHOUT this introduction the name *Parnassius* Latreille is used for convenience in the sense of Munroe (1960), i.e. to include *Eukoramius* Bryk, *Kailasius* Moore, *Koramius* Moore, *Lingamius* Bryk and *Tadumia* Moore. In the catalogue itself, however, the statements of current status and generic assignment are taken from the 'Index zu Parnassiana 1–6 und Parnassiana nova I–XXXVIII' given by Eisner (1966*a* : 82–190), in which all these names are treated as full genera.

The butterflies of the genus *Parnassius* have long been favoured with the attentions of taxonomists, the multiplicity of variations in wing pattern affording an opportunity for the descriptions of numerous subspecies and forms, principally in the works of Fruhstorfer, Bang-Haas, Bryk and Eisner. Type-specimens of many taxa named by these authors are deposited in the British Museum (Natural History) (abbreviated in this paper to BMNH), together with the type-material of a number of other workers.

Eisner (1966*a*) published a catalogue of the type-material of *Parnassius* in his collection, and in the same year Bernardi & Viette (1966) published a similar work

*

on the collections of the Muséum National d'Histoire Naturelle, Paris. It is hoped that these lists, together with the present work, will give considerable assistance to any future workers dealing with the nomenclature of this genus.

The irregularity of the type-designations of many authors has given rise to some difficulty and an outline of the type-categories employed here is given to clarify the approach adopted. Bryk, and Eisner in his earlier works, based most of their descriptions on '1 ♂, 1 ♀ Typen' and a series of 'Cotypen'. These series are regarded as syntypic unless covered by Eisner (1966*a*). In this latter work Eisner lists the male 'Typen' as 'Holotypes', the female 'Typen' as 'Allotypes', and the remainder of the series as 'Paratypes'. While I do not feel that he is really justified in taking this action, I am nevertheless regarding these as being in effect lectotype designations, leaving the remainder of the series as paralectotypes. The type-series of other authors have been regarded as syntypic unless the original descriptions indicate that the taxa are based on a single specimen only, or a holotype is clearly designated. A single specimen stated in the legends of plates to be the 'Type' is regarded as a holotype. Any noted lectotype designation is taken into account; however, I do not regard the specimens cited by Bryk (1935) as being lectotypes. The name *ariadne* Lederer is used in place of *clarius* Eversmann (Hemming, 1934).

I have included names originally established with infrasubspecific rank and have given only the original author and date, even when subsequent authors have elevated them to a rank of the species-group. Because of the extremely extensive literature that has been published on *Parnassius*, it is impossible to state with any degree of certainty when a name was first made available, or indeed if it ever has been.

In this work the taxa are listed alphabetically, followed by the reference to the original description, together with the original status and combination. The status and number of types are given along with the data quoted directly from the labels beneath the specimens, the sign '/' indicating the extent of each label. Where the data on the labels do not correspond with the published data, the latter are also quoted. The current status and combination, taken from Eisner (1966*a*), is noted where it differs from the original status and combination. Emended spellings cited by Eisner (1966*a*) are recorded together with the author of the original emendation; no judgement is made on the justification of the emendations. A reference is given to any noted lectotype designation. The synonymy, where given, is taken from Bryk (1935). Lectotypes are designated for *Parnassius epaphus* Oberthur, *Parnassius jacquemontii* Boisduval and *Parnassius jacquemontii himalayensis* Elwes. It is hoped that this action will finally stabilize the nomenclature of these taxa following the erroneous action of Elwes (1886). No other lectotypes are designated as I feel this should be done in a revisional work rather than a catalogue. A note is included on the synonymy of *Parnassius glacialis* Butler.

Some years ago a number of the *Parnassius* 'types' housed in the BMNH were stolen and many of the locality labels removed from the specimens. After recovery these labels were replaced but it cannot be certain that they were attached correctly in every case. This could possibly account for some of the discrepancies that occur between the data on the specimens and what was published in the original description.

This catalogue has arisen partly from work involving the re-arrangement of the BMNH *Parnassius* collection, subsequent to the re-identification of the great bulk of the non-type material by Dr C. Eisner of Leiden. Special acknowledgment is due to Dr Eisner for the enormous amount of work he has carried out on the collection. I wish to thank my friends and colleagues at the BMNH for their help and advice in the preparation of this work, especially Messrs R. I. Vane-Wright and T. G. Howarth. I am also indebted to Mr P. V. York, who produced the photographs.

## LECTOTYPE DESIGNATIONS

Boisduval (1836) described *Parnassius jacquemontii* from a mixed series of two males and two females, the males being of one species, the females of another. Part of the syntypic series was figured by Blanchard (1844). In the legends of the plate he confused the sexes, the specimens being of the opposite sex to that given. Oberthür (1879) applied the name *jacquemontii* Boisduval to the males of the original series, since they were described first, and named the females as a new species, *Parnassius epaphus* Oberthür.

No further confusion would have arisen, but Elwes (1886), ignoring the laws of priority, took the *females* of Boisduval's syntypic series as *jacquemontii* Boisduval and regarded *epaphus* Oberthür as a synonym. He also described a subspecies of *jacquemontii* Boisduval (as interpreted by Oberthür) as *Parnassius actius* var. *himalayensis*, which he doubtfully associated with Boisduval's original description. Oberthür (1891) pointed out the erroneous action of Elwes. Rothschild (1909) regarded *himalayensis* Elwes as an 'absolute' synonym of *jacquemontii* Boisduval. He was however unjustified in this action, as Elwes did not state that his *himalayensis* was definitely conspecific with the males of Boisduval's original series (*jacquemontii*). The name *himalayensis* is currently used for a subspecies of *Parnassius jacquemontii*.

The following three lectotype designations are therefore made to stabilize the current nomenclature of these species.

### ***Parnassius epaphus*** Oberthür

(Pl. 1, fig. 10)

[*Parnassius jacquemontii* Boisduval, 1836 : 400. ♀, nec ♂.]
[*Parnassius jacquemontii* Boisduval; Blanchard, 1844 : 16, pl. 1, fig. 3. ♀, nec ♂.]
[*Parnassius jacquemontii* Boisduval; Gray, 1853 : 75, pl. 12, figs 1–2.]
*Parnassius epaphus* Oberthür, 1879 : 23. LECTOTYPE ♂, TIBET (BMNH), here designated [examined].
[*Parnassius jacquemontii* Boisduval; Elwes, 1886 : 36.]
*Parnassius epaphus* Oberthür; Oberthür, 1891 : 9, pl. 1, figs 4–5.

*Parnassius epaphus* Oberthür; Stichel, 1906 : 83.
*Parnassius epaphus* Oberthür, Verity, 1911 : 315, pl. LXIV, figs 1–3.
*Parnassius epaphus* Oberthür; Bryk, 1935 : 270.

Described from one female in the Oberthür collection from 'Tartarie chinoise', together with the male and female figured by Gray (1853). The former, which should have passed to the Muséum National d'Histoire Naturelle, Paris, is not included by Bernardi & Viette (1966) and appears to be lost. The latter specimens are in the BMNH but the labels attached beneath give the locality as 'Thibet', not 'Himalaya Mountains' and 'Chinese Tartary' as stated by Gray (1853). Verity (1911) illustrated three specimens of Gray, two of which are stated to be the specimens figured by Gray; however, he wrongly associated the female with the original figure. The specimen shown in fig. 3 is undoubtedly that illustrated by Gray, not the female in fig. 2 as given in the legends of the plate.

The two specimens of Gray bear the labels 'Thibet, Maj. Charlton' and 'Figuré par R. Verity, Rhopalocera Palaearctica, epaphus Obth., co-type.' Both specimens have coloured 'Type' labels (BMNH origin) and additional labels referring them to Gray's catalogue (1853). The male (Pl. 1, fig. 10) is hereby designated lectotype and has been labelled accordingly (type no. Rh. 17286), and the female is similarly designated paralectotype.

### ***Parnassius jacquemontii himalayensis*** Elwes

(Pl. 1, fig. 4)

*Parnassius actius* var. *himalayensis* Elwes, 1886 : 30. LECTOTYPE ♂, INDIA: Lahoul (BMNH), here designated [examined].
*Parnassius jacquemontii himalayensis* Elwes; Oberthür, 1891 : 9, pl. II, figs 12–13.
*Parnassius jacquemontii* Boisduval; Rothschild, 1909 : 14.
*Parnassius jacquemontii himalayensis* Elwes; Bryk, 1935 : 261.

Described from a series of specimens from Lahoul, taken between July 15th and August 28th, 1884, at various elevations between 11,500 and 15,000 feet. There are in the BMNH three males and four females which certainly originate from this series. All of the males and two of the females bear the label 'Lahoul, 12,000 ft., Young, 8. 84'. The remaining two females have similar labels differing slightly only in the date given, one of these being captured on '7.8.84' and the other on '14.8.84'. In addition each specimen bears the label 'Elwes Coll., 1902–85'. One of the males (Pl. 1, fig. 4) is hereby designated lectotype and has been labelled accordingly (type no. Rh. 17287) and the remainder of the series are similarly designated paralectotypes.

### ***Parnassius jacquemontii*** Boisduval

*Parnassius jacquemontii* Boisduval, 1836 : 400. LECTOTYPE ♂, HIMALAYAS. Specimen presumed lost; figure here designated.
*Parnassius jacquemontii* Boisduval; Blanchard, 1844 : 16, pl. 1, fig. 4, ♂, nec ♀.
*Parnassius jacquemontii* Boisduval; Oberthür, 1879 : 23, pl. 2, fig. 5.

Boisduval (1836) based his original description of the male of *jacquemontii* on two specimens, one of which is figured by Blanchard (1844). The Boisduval collection of Rhopalocera passed to Oberthür, who listed and figured one male 'Type' of *jacquemontii* Boisduval in his catalogue of *Papilionidae* (1879). The second male, not mentioned, was presumably lost. The type-specimens of *Parnassius* in the Oberthür collection should have passed to the Muséum National d'Histoire Naturelle, Paris. Bernardi & Viette (1966) do not list this species in their catalogue, so the location of the remaining 'Type' is unknown; it is also almost certainly lost.

In order to stabilize the name of this taxon, the original specimen of Boisduval, illustrated in the figure given by Oberthür (1879 : pl. 2, fig. 5), is hereby designated lectotype.

### A NOTE ON THE SYNONYMY OF *PARNASSIUS GLACIALIS* BUTLER

Butler (1866) and de Motschoulsky (1866) described the same taxon as *Parnassius glacialis* Butler and *P. citrinarius* de Motschoulsky respectively. The date of publication of the original description of *glacialis* is certainly the 11th October 1866. It is probable that *citrinarius* should have priority; the original description appears in the first part of a four-part volume published at intervals throughout 1866 but further research is required to determine the precise date of publication. Since the publication date of Butler's original description is known, I propose to use the name *glacialis* in this work.

An annotated synonymy of this taxon is set out below.

### ***Parnassius glacialis*** Butler

(Pl. 1, fig. 3)

*Parnassius glacialis* Butler, 1866 (11th October): 50.
*Parnassius citrinarius* de Motschoulsky, 1866 : 189.
*Parnassius glacialis* Butler; Kirby, 1871 : 513. [*Parnassius citrinarius* de Motschoulsky given separate entry on same page.]
*Parnassius glacialis* Butler; Elwes, 1886 : 47. [*Parnassius citrinarius* de Motschoulsky first treated as junior synonym of *Parnassius glacialis* Butler.]
*Parnassius citrinarius* de Motschoulsky; Leech, 1893*a* : 506. [*Parnassius glacialis* Butler first treated as junior synonym of *Parnassius citrinarius* de Motschoulsky.]
*Parnassius citrinarius* de Motschoulsky; Stichel, 1906 : 21. [*Parnassius glacialis* Butler cited as synonym.]
*Parnassius stubbendorfi* var. *citrinarius* de Motschoulsky; Verity, 1907 : 101. [*Parnassius glacialis* Butler cited as synonym.]
*Parnassius stubbendorfi citrinarius* de Motschoulsky; Rothschild, 1918 : 226.
*Parnassius glacialis* Butler; Hering, 1931 : 10.
*Parnassius stubbendorfi glacialis* Butler; Bryk, 1935 : 128. [*Parnassius citrinarius* de Motschoulsky cited as synonym.]
*Parnassius mnemosyne glacialis* Butler; Fischer, 1950 : 70.
*Parnassius glacialis* Butler; Shirozu & Hara, 1960 : 19.
*Parnassius glacialis* Butler; Eisner, 1966*a* : 117. [*Parnassius citrinarius* de Motschoulsky cited as synonym on p. 98.]
*Parnassius glacialis* Butler; Yokoyama & Wakabayashi, 1968 : 2.
*Parnassius citrinarius* de Motschoulsky; Kurentsov, 1970 : 15.

## A LIST OF THE TYPE-SPECIMENS OF *PARNASSIUS* IN THE BRITISH MUSEUM (NATURAL HISTORY)

***acco*** Gray, 1853 : 76, pl. XII, figs 5–6 (as sp. *Parnassius*). 2 ♀ syntypes. 1 ♀, Thibet, Major Charlton. 1 ♀, Tibet, Major Charlton. (Pl. 1, fig. 9).

Currently placed as a species of ***Tadumia*** Moore.

Described from Chinese Tartary, 16,000 ft, but these specimens are certainly part of the original series.

***acconus*** Fruhstorfer, 1903*a* : 149 (as subsp. of *Parnassius acco*). 3 ♂, 2 ♀ syntypes. Sikkim, Regenzeit, Fruhstorfer.

Currently placed as a subspecies of ***Tadumia simo*** Gray.

Described from Sikkim, Juli, 15–16,000 ft.

***acdestis*** Grum-Grshimailo, 1891 : 446 (as var. of *Parnassius delphius*). 1 ♀ syntype. Sinin Alp. (Pl. 1, fig. 5.)

Currently placed as a species of ***Koramius*** Moore.

***actinoboloides*** Bang-Haas, 1928 : 59 (as subsp. of *Parnassius jacquemonti*). 2 ♂, 2 ♀ syntypes. Kansu sept., Tumöngtsze, Richthof. mont. Juli. 2700 m./Co-Type e Collection Bang-Haas.

Currently placed as a subspecies of ***Parnassius actius*** Eversmann.

Described from China sept. occ. Kansu sept. Richthofen mont. südwestlich Liang-tschou (Tumöngtsze), Juli. 2700 m.

***adamellicus*** Kunz, 1922 : 13, figs 3–4 (as var. of *Parnassius mnemosyne*). 1 ♂, 1 ♀ syntypes. 1 ♂, 29.vi.1921. Val di Genova, Vanezia Trident, Dr. Ed. Kunz./Coll. Eisner, Berlin. 1 ♀, 27.vi.1918. Val di Genova, Vanezia Trident, Dr. Ed. Kunz./ex. Coll. Bryk.

Currently placed as a subspecies of ***Parnassius mnemosyne*** L.

***adulanus*** Fruhstorfer, 1921*b* : 44 (as subsp. of *Parnassius apollo*). 35 ♂, 3 ♀ syntypes. 5 ♂, Val Pontirone, 27.7.18. 1200–2000 m. Fruhstorfer. 30 ♂, 3 ♀, Val Blenio, 12–1500 m. vii. H. Fruhstorfer.

***affinis*** Peschke & Eisner, 1934 : 40, figs 5–6 (as subsp. of *Parnassius delphius*). 4 ♂, 4 ♀, paralectotypes. 3 ♂, 3 ♀, Dardistan, Dubunni-monts. 4500 m. vii. 34. Peschke, Teschen. 1 ♂, 1 ♀, Doubounni-Montes, Dardistan. 4,500 m, 7. 1934.

Currently placed as a subspecies of ***Koramius delphius*** Eversmann.

Described from Doubounni montes, Gilgit (4500 m, VII. 1934).

Lectotype designated by Eisner, 1966*a* (see Introduction).

***agyiens*** Fruhstorfer, 1921 : 29 (as subsp. of *Parnassius apollo*). 6 ♂, 3 ♀, syntypes. 4 ♂, 2 ♀, Ampezzo, Fruhstorfer. 1 ♂, Sigilletto. 15. Aug. 1915. 1 ♂, Andraz. 7. 12. 1 ♀, Andraz, Fruhstorfer.

(Emend. ***agyieus*** Fruhstorfer, Belling, 1923 : 287.)

***aino*** Bryk, 1932 : 5 (as subsp. of *Tadumia imperator*). 2 ♂, 4 ♀ syntypes. 1 ♀, China : Yunnan, Mekong Valley. 8,000′ 24.viii.1922. F. Kingdon Ward. 1 ♂, 2 ♀, Ká-gur-pu, Up. Mekong Valley. July 9th 1914. F. Kingdon Ward. 1 ♂, 1 ♀, A-tun-tzu, Yunnan. lat. 28°30′. long. 98°50′. July 14 1913. (Kingdon Ward).

Currently placed as a subspecies of ***Eukoramius imperator*** Oberthür.

Described from Yunan, A-tum-tzu, Breite : 28°30′, Länge 98°50′; 1500 Fuss Höhe: Mekong Valley, but these specimens are certainly part of the original series.

***albicans*** Fruhstorfer, 1898 : 147 (as subsp. of *Parnassius hardtwickii* [lapsus for *hardwickei*]). 1 ♂ syntype. India. 16,000′. Fruhstorfer.

Currently placed as a subspecies of ***Lingamius hardwickei*** Gray.

Described from Lochung Valley and Donkia-Pass, Native-Sikkim, but these specimens are certainly part of the original series.

***albulus*** Honrath, 1889 : 161, pl. I, fig. 1 (as var. of *Parnassius delphius*). 2 ♂, 2 ♀ syntypes. 1 ♂, Alai m./specimen typicum. 1 ♂, 2 ♀, ex speciminibus typicis.

Currently placed as a subspecies of ***Koramius delphius*** Eversmann.

***alini*** Bryk & Eisner, 1937 : 12 (as subsp. of *Parnassius nomion*). 1 ♂ paralectotype. Maoreschan, Mandschurei. 1935.

Lectotype designated by Eisner, 1966*a* : 34 (see Introduction).

***alpestris*** Verity, 1911 : 314, pl. LXIII, figs 19–20 (as form of *Parnassius delius* var. *intermedius*). 1 ♂, 1 ♀ syntypes. S.E. Altai, Tchuja Mts. 6–8000 ft. 16.7.98. H. J. Elwes.
Currently placed as a subspecies of *Parnassius phoebus* F.

***altaica*** Verity, 1911 : 319, pl. LXIV, fig 19 (as race of *Parnassius eversmanni*). 4 ♂ syntypes. S.E. Altai, Tchuja Mts. 6-8000 ft. H. J. Elwes. 2 ♂, 15.7.98. 1 ♂, 13.7.98. 1 ♂, 14.7.98.
Replaced by *lacinia* Hemming (1934 : 198) and currently placed as a subspecies of *Parnassius eversmanni* Ménétriés.

***amanusica*** Bryk & Eisner, 1931*a* : 3, fig. 3 (as subsp. of *Parnassius mnemosyne*). 1 ♂, 1 ♀ syntypes. Amanus Mts., Syria.

***amurensis*** Verity, 1911 : 321, pl. LXV, figs 17–18. (as race of *Parnassius stubbendorfi*). 2 ♂, 1 ♀ syntypes. 1 ♂, Wladivostok 480./Zell. Coll. 1884. 1 ♂, 1 ♀, Wladiwostok./Elwes Coll.
Currently placed as a subspecies of *Parnassius stubbendorfi* Ménétriés.

***anachoreta*** Bryk, 1936 : 3 (as subsp. of *Parnassius glacialis*). 1 ♂ syntype. Tapaishan im Tsinling, Sued-Shensi. Ca. 1700 m. 22.5.1936. H. Höne.
Described from Taipaishan (Singling), Südshensi.

***andreji*** Eisner, 1930 : 5, pl. I, figs 9-10 (as subsp. of *Parnassius simo*). 6 ♂ paralectotypes. Sud-Tatungsche Berge, Nanschan, Alpenzone. 22-26.7.1929. Leg. W. Beick.
Currently placed as a subspecies of *Tadumia simo* Gray.
Described from Süd-Tatungsche Berge, Nanschan Gebiet, leg. Beik. vii. 1929.
Lectotype designated by Eisner, 1966*a* : 54 (see Introduction).

***angorae*** Bryk & Eisner, 1931*a* : 3 (as subsp. of *Parnassius mnemosyne*). Holotype ♂. Asia Minor, nr. Yozgat. 5000′. 16.vi.1918. Capt. W. W. Phillips. 1 ♂ paratype. Asia Minor./Elwes Coll.

***apolloformis*** Verity, 1911 : 313, pl. LVIII, fig. 11 (as ab. of *Parnassius actius*). Holotype ♂. Karagai tau.
Currently placed as a form of *Parnassius actius cassius* Bryk and Eisner.

***arakawai*** Bang-Haas, 1938*a* : 19, pl. 1, figs 10–11 (as subsp. of *Parnassius stubbendorfi*). 2 ♂, 1 ♀ syntypes. Corea central, Kiujo, Mons Myoka. 2-8. Mai. 1938. Co-Type. O. Bang-Haas.

***ariovistus*** Fruhstorfer, 1911 : 96 (as subsp. of *Parnassius mnemosyne*). 6 ♂, 3 ♀ syntypes. 1 ♂, Urach. 6.6. 1897. 2 ♂, Neu Ulm, Fruhstorfer. 3 ♂, 3 ♀, Lautertal, Fruhstorfer.
Described from Süddeutschland, Urach in Württemberg. Juni 1897. Juni 1905. Lautertal bei Ulm, 2. Juli 1909. Neu Ulm.

***arnoldiana*** Bang-Haas, 1938 : 57 (as subsp. of *Koramius szechenyii*). 1 ♂, 1 ♀ syntypes. China sept. occ., Pullow mont., Min-schan occ. 3500 m. Juli./Co-Type e Collection Bang-Haas.

***artemidor*** Fruhstorfer, 1921*e* : 78 (as subsp. of *Parnassius apollo*). 1 ♂, 1 ♀ syntypes. Carpathen, Fruhstorfer.
Not included by Eisner, 1966*a*.

***atkinsoni*** Moore, 1902 : 121, pl. 412, fig. 2 (as sp. of *Koramius*). 2 ♀ syntypes. Darjiling, Hewitson Coll.
Currently placed as a subspecies of *Koramius delphius* Eversmann.
Described from two females in the Hewitson collection from Pir Pinjal, N. Kashmir, but one of the 'Darjiling' specimens is certainly that figured by Moore, 1902. The labels have probably been wrongly associated with the syntypes, 'Pir Pinjal' being the correct locality.

***aurora*** Bang-Haas, 1933 : 261 (as subsp. of *Parnassius nomion*). 3 ♂ syntypes. Transbaical or., Pokrowka am Amur. 800 m. Juli./Co-Type e Collection Bang-Haas.
Described from Gau Ferner Osten (= Transbaical). Osten: Pokrovka a. Amur, gef. Juli 1932, und Poworotnoje (= Novorotnaja) a. Schilka Fluss. Westen: Kentei Geb. östl. v. Kiachta, Ende Juni bis Mitte Juli.

***avinoffi*** Verity, 1911 : 316, pl. LIII, fig. 11 (as race of *Parnassius simo*). 1 ♂ syntype. A. Avinoff in exchange. 12.vii.1909. Hindu Kush, Beik Pass. 13,000′.
Currently placed as a subspecies of *Tadumia simo* Gray.

***badius*** Bang-Haas, 1938*a* : 21 (as subsp. of *Parnassius nomion*). 1 ♂, 1 ♀ syntypes. Kansu occ., Liang-tschou, Richthofen mont., mar. 2500 m. Juli./Co-Type. O. Bang-Haas.

***baileyanus*** Bryk, 1932 : 3, fig. 1 (as subsp. of *Tadumia baileyi*). Holotype ♂. W. China, Rama La. 15,000′. 26.5.11.

Currently placed as a subspecies of *Tadumia acco* Gray.

***baileyi*** South, 1913 : 362 (as subsp. of *Parnassius acco*). 4 ♂, 1 ♀ syntypes. 1 ♂, W. China, Rama La. 15,000′. 26.5.11. 2 ♂, Litang. 13,800 ft. 28.v.1911. F. M. Bailey. 1 ♂, S.E. Tibet, Litang. 17,000′. 28.5.1911. Capt. F. M. Bailey. 1 ♀, S.E. Tibet, Litang. 13,800 ft. 28.5.1911. Capt. F. M. Bailey.

Currently placed as a subspecies of *Tadumia acco* Gray.

Described from Rama la (15,000 ft), May 26; Litang (13,800 ft), May 28.

***baltistani*** Bang-Haas, 1934 : 8 (as subsp. of *Parnassius hardwickei*). 3 ♂, 1 ♀ syntypes. 1 ♂, Kapalu./Co-Type e Collection Bang-Haas. 2 ♂, 1 ♀, India sept. or., Baltistan, Kapalu. 5100 m. Juni./Co-Type e Collection Bang-Haas.

Currently placed as a subspecies of *Lingamius hardwickei* Gray.

Described from India sept. or., Baltistan, Kapalu, Juni, 5100 m.

***baroghila*** Tytler, 1926 : 250, pl. IV, fig. 1 (as subsp. of *Parnassius discobolus*). 6 ♂, 2 ♀, syntypes. Baroghil, Shawan Shung, Yarkhun, 7.23.

Currently placed as a subspecies of *Parnassius jacquemontii* Boisduval.

Described from N.E. Chitral, Baroghila Pass, but these specimens are certainly part of the original series.

***basharianus*** Eisner, 1969 : 174 (as subsp. *Kailasius charltonius*). 17 ♂, 16 ♀ paratypes. 2 ♂, 1 ♀, Tsuling Pass. 5000 m. August. Bashar State. 4 ♂, 6 ♀, Thibet occid., Churmurti, Shilang (Shiring) Pass. August 4800 m. 10 ♂, 8 ♀, Tum Tum Thang am Spiti-Fluss, N. W. Himalaya. Juli. 5000 m. 1 ♂, N. India, Tehri Garhwel, Thibet Road. 12,500 ft. 1 ♀, Stargyugsa, Bashahr State. 5000 m. August.

***basipicta*** Bryk, 1932*a* : 21. (as form of *Lingamius cephalus*). 1 ♀ syntype. Thibet, Amdo./Leech Coll.

Currently placed as a form of *Koramius cephalus* Grum-Grshimailo.

***batava*** Fruhstorfer, 1921*m* : 41 (as subsp. of *Parnassius mnemosyne*). 1 ♀ syntype. 20.5.1918. Umgebung Passau.

***blachieri*** Fruhstorfer, 1921*j* : 16 (as subsp. of *Parnassius delius*). 3 ♂, 2 ♀ syntypes. 1 ♂, Veglia. 5.8.09. 2 ♂, 1 ♀, Veglia. 5.8.09./Ch. Blachier. 1 ♀, Veglia. 25.7.12./Ch. Blachier.

Currently placed as a subspecies of *Parnassius phoebus* F.

Described from Alpe Veglia im oberen Val Cairasca, dem westlichen Seitental des Val Antigorio, Piemont. 5.viii. 1909. und 25.vii.1912.

***boedromius*** Püngeler, 1901 : 177, pl. 1, figs 3–4 (as sp. of *Parnassius*). 1 ♂, 1 ♀ syntypes. Aksu.

Currently placed as a subspecies of *Tadumia simo* Gray.

***bogosi*** Bang-Haas, 1934*c* : 135 (as subsp. of *Parnassius nordmanni*). 4 ♂, 2 ♀ syntypes. Kaukasus sept., Tindi, Bogos mont. 4000 m. Anf. Aug./Cotype e Collection Bang-Haas.

Described from Caucasus sept., Daghestan occ., Berg Bogos, Ort Tindi, circa 4000 m. Anf. August.

***bohemien*** Bryk, 1914 : 35 (as subsp. of *Parnassius mnemosyne*). 2 ♂, 1 ♀ paralectotypes. 1 ♂, Gross Wosek. v.1913. 1 ♂, 1 ♀, Gross Wosek. Böhmen. Mai 1913.

Described from Gross Wosek an der Elbe.

Lectotype designated by Eisner, 1966*a* : 9 (see Introduction).

***borussianus*** Fruhstorfer, 1916*a* : 49 (as subsp. of *Parnassius mnemosyne*). 1 ♂, 1 ♀ syntypes. Rominten, Fruhstorfer.

Described from Ostpreussen, but these specimens are certainly part of the original series.

***bosniacus*** Rothschild, 1918 : 223 (as subsp. of *Parnassius mnemosyne*). 16 ♂, 7 ♀ syntypes. Mahnjacageb, Bosn. 1200 m. Mitte Juli.

Currently placed as a synonym of *Parnassius mnemosyne leonhardiana* Fruhstorfer.

Described from Mahnjaca Mountains, Bosnia, 1,200 metres = 3,900 ft., June.

***britae*** Bryk, 1932 : 2 (as subsp. of *Tadumia tenedius*). 1 ♂, 11 ♀ syntypes. Sredne-Kolymsk, N. E. Siberia. 67°50′ n. lat. June 1906.

***bromkampi*** Bang-Haas, 1933 : 261 (as subsp. of *Parnassius stubbendorfi*). 1 ♂ syntype. Kansu mer. or., Min, Min-schan or. 3000 m. Juli./Cotype. O. Bang-Haas.

***buddenbrocki*** Bang-Haas, 1938 : 59 (as subsp. of *Tadumia simo*). 2 ♂, 1 ♀ syntypes. China sept. occ., Pullow mont, Min-schan occ. 3500 m. Juli./Cotype e Collection Bang-Haas.

***buehleri*** Eisner, 1956 : 157, pl. I, figs 1–2 (as subsp. of *Parnassius apollo*). 2 ♂ paratypes. Gallia mer., Val de Severessette. 1200 m. 20–25.7.54. leg. Leinfest. Wien.

***bulgarica*** Eisner, 1936 : 9 (as subsp. of *Parnassius mnemosyne*). 3 ♂, 1 ♀ paralectotypes Pisanec am lom, N. O. Bulgarien. 300 m. v.1935. leg. Heinrich.

Lectotype designated by Eisner, 1966*a* : 10 (see Introduction).

***caesar*** Grum-Grshimailo, 1885 : 247 [nomen nudum]; 1890 : 187 [nomen nudum]; Elwes 1886 : 41 [nomen nudum] (as sp. of *Parnassius*). 1 ♂, 2 ♀ paralectotypes. 1 ♂, Transalai. Kyzyl-Art-Pass (Probable translation of original Russian locality label). 1.viii.87./Coll. Gr. Gr./Elwes Coll. 1 ♀, Transalai. mont./Kyzyl-Art-Pass (Probable translation of original Russian locality label). 1.viii.87./Coll. Gr. Gr. Elwes Coll. 1 ♀. Transalai./Coll Gr. Gr. Elwes Coll.

Currently placed as a subspecies of *Parnassius actius* Eversmann.

Eisner & Sheljuzhko (1965 : 214, legend) effectively designated a male from the Grum-Grshimailo Collection (in BMNH) as the lectotype of this taxon, and three other specimens as paralectotypes ('lectoallotype' and 2 'paratypes'). The latter specimens are still present in the BMNH but the former 'lectotype' is missing. However, the validity of *caesar* as a nomenclatorially available name attributable to Grum-Grshimailo would seem to require further investigation.

***caloriferus*** Fruhstorfer, 1921*a* : 41, fig. 3 (as subsp. of *Parnassius apollo*). 1 ♀ syntype. Iselle. 21.7.05./Ch. Blachier.

***cardinal*** Grum-Grshimailo, 1887 : 397 (as var. of *Parnassius delphius*). 1 ♂ syntype. Tuptschet, Darwas./Orig./Coll. Gr. Gr.

Currently placed as a subspecies of *Koramius delphius* Eversmann (Emend. *cardinalis* Grum-Grshimailo, Eisner, 1959 : 144.)

***carmenta*** Fruhstorfer, 1916 : 26 (as subsp. of *Parnassius mnemosyne*). 1 ♂ syntype. Voralberg, Dr Rhomberg.

***catilina*** Eisner & Peschke, 1934 : 41 (as subsp. of *Parnassius actius*). 3 ♂, 3 ♀ paralectotypes. Dardistan, Dubunni-mounts. 4500 m. vii. 1934. Peschke, Teschen.

Lectotype designated by Eisner, 1966*a* : 27 (see Introduction).

***cephalus*** Grum-Grshimailo, 1891 : 446 (as sp. of *Parnassius*). 1 ♂, 1 ♀ syntypes. Liang-tcha-sien (Probable translation of original Russian locality label)./orig./Coll. Gr. Gr./Elwes Coll. (Pl. 1, fig.8.)

Currently placed as a species of *Koramius* Moore.

***cervinicolus*** Fruhstorfer, 1907 : 199 (as subsp. of *Parnassius phoebus*). 20 ♂, 9 ♀ syntypes. 1 ♂, 1 ♀, Simplon. 1905. H. Fruhstorfer. 19 ♂, 8 ♀, Zermatt. 1906. H. Fruhstorfer.

Described from Mont Cervin and Matterhorn, but these specimens are certainly part of the original series.

***cetius*** Fruhstorfer, 1909*a* : 161 (as subsp. of *Parnassius apollo*). 17 ♂, 4 ♀ syntypes. Wachau, Fruhstorfer.

***charltonius*** Gray, 1853 : 77, pl. XII, fig. 7 (as sp. of *Parnassius*). 1 ♀ syntype. Thibet, Major Charlton. (Pl. 1, fig. 2.)

Currently placed as a species of *Kailasius* Moore.

Described from Chinese Tartary, 15,000 ft, but this specimen is certainly part of the original series.

***chingamensis*** Bryk & Eisner, 1932*b* : 26 (as subsp. of *Parnassius nomion*). 1 ♂, 1 ♀ paralectotypes. Mandschur. sept. occ., Buchalu, Chingan mont. sept. 1100 m. Juli./Co-Type e Collection Bang-Haas.

Described from Buchatu, Gudschal-Tal, Chingan mont. sept. 1100 m. VII.

(Emend. *chinganensis* Bryk and Eisner, Eisner, 1955 : 203.)

Lectotype designated by Eisner, 1966*a* : 34 (see Introduction).

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***chitralensis*** Moore, 1902 : 107, pl. 406, figs 2–2a (as sp. of *Parnassius*). 1 ♂ syntype. Chitral./ Ex. Grose-Smith. 1910.

Currently placed as a subspecies of *Parnassius jacquemontii* Boisduval.

***chitralica*** Verity, 1911 : 317, pl. LXIV, figs 11–12 (as race of *Parnassius delphius* var. *hunza*). 1 ♂, 1 ♀ syntypes. 1 ♂, Chitral, Baroghil Valley. viii. 1902. El. 12,000 ft. Coll. G. A. Leslie and W. H. Evans. 1 ♀, Chitral. Coll. G. A. Leslie and W. H. Evans.

Currently placed as a subspecies of *Koramius delphius* Eversmann.

***christophi*** Bryk & Eisner, 1932*f* : 90 (as subsp. of *Parnassius nordmanni*). 2 ♂ paralectotypes. 1 ♂, Tschugus. 5.9.1926. 3440 metr. 1 ♂, Tschugusch, Cauc. 2000 m. IX.

Lectotype designated by Eisner, 1966*a* : 17 (see Introduction).

***chrysophorus*** Fruhstorfer, 1921*d* : 65 (as subsp. of *Parnassius apollo*). 2 ♂ syntypes. Sud-pyren., Spanien, Fruhstorfer.

***chumurtiensis*** Bang-Haas, 1928 : 59 (as subsp. of *Parnassius acco*). 7 ♂, 8 ♀ syntypes. Tibet occid., Chumurti, Shilang (Shiring) Pass. August. 4,800 m./Co-Type e Collection Bang-Haas.

Currently placed as a subspecies of *Tadumia acco* Gray.

***claudius*** Belling, 1915 : 655 (as subsp. of *Parnassius apollo*). 5 ♂, 3 ♀ syntypes. Karwendel Geb., H. Belling. 1 ♂, 1 ♀, 28. Juli. 1912. 1 ♂, 10. Aug. 1913. 1 ♀, 11. Juli. 1915. 2 ♂, 6. Aug. 1915. 1 ♂, 10. Aug. 1915. 1 ♀, 20. Aug. 1915.

***compositus*** Bryk & Eisner, 1932*c* : 29 (as subsp. of *Parnassius mnemosyne*). 2 ♂, 1 ♀ paralectotypes. 2 ♂, Aggsbach-Wachau. 26.5.1931. leg. F. Müller. 1 ♀, N. O. Peilstein. 7.vi.1930.

Lectotype designated by Eisner, 1966*a* : 9 (see Introduction).

***confederationis*** Fruhstorfer, 1921*k* : 20 (as subsp. of *Parnassius delius*). 21 ♂, 5 ♀ syntypes. Maderanertal. 19–2100 m. 25.vii.1917.

Currently placed as a subspecies of *Parnassius phoebus* F.

Described from Maderanertal, Kanton Uri, Urschweiz. 22–29. VII. 1917 ca. 1300 m.

***conjungens*** Bryk & Eisner, 1932*f* : 82 (as subsp. of *Parnassius stubbendorfi*). 1 ♂ paralectotype. Chingan mont, sept., Buchatu, Mandschur occ. Juli. 1100 m./Coll. Eisner.

Lectotype designated by Eisner, 1966*a* : 16 (see Introduction).

***correctus*** Bryk, 1932*a* : 21, 42 (as subsp. of *Lingamius hardwickei*). 1 ♀ syntype. Narkundah, H. McArthur Coll. April. 1880./9000/Leech Coll.

Currently placed as a form of *Lingamius hardwickei hardwickei* Gray.

***craspedontis*** Fruhstorfer, 1908 : 12, 1908*b* : 192 (as race of *Parnassius mnemosyne*). 6 ♂, 4 ♀ syntypes. Saratow. 19–07. A. Frindolin.

Currently placed as a subspecies of *Parnassius mnemosyne* L.

***cuneifer*** Fruhstorfer, 1908 : 12 (as subsp. of *Parnassius mnemosyne*). 3 ♂, 1 ♀ syntypes. Ortler, Fruhstorfer.

***cyrnus*** Fruhstorfer, 1906 : 139 (as subsp. of *Parnassius mercurius*). Holotype ♀. Aksu, Fruhstorfer.

Currently placed as a subspecies of *Parnassius jacquemontii* Boisduval.

***daubi*** Fruhstorfer, 1903*b* : 49 (as subsp. of *Parnassius apollonius*). 1 ♂, 1 ♀ paralectotypes. Sult. Harret Geb., Sary Ob. 11,000′. Fruhstorfer.

Described from Serafschan Gebirge, südöstlich von Samarkand. Von Funke am Sary Ob. Lectotype designated by Ebert, 1971 : 159.

***debilis*** Fruhstorfer, 1921*g* : 114 (as subsp. of *Parnassius apollo*). 3 ♂ syntypes. Thorens. 18.7.1911. Fruhstorfer.

***dejotaurus*** Fruhstorfer, 1916 : 26 (as subsp. of *Parnassius mnemosyne*). 2 ♂ syntypes. Bulg., Tschamkorija, M. Hilf. 1911. Coll. O. Leonard.

***demaculatus*** Fruhstorfer, 1908 : 12 (as subsp. of *Parnassius mnemosyne*). 2 ♂, 2 ♀ syntypes. Ungarn, Fruhstorfer.

***dentata*** Austaut, 1889 : 149, pl. 21, figs 1–2 (as var. of *Parnassius clarius*). 1 ♂ syntype. Coll. Austaut.

Currently placed as a form of *Parnassius ariadne ariadne* Lederer.

***dentata*** Bang-Haas, 1938*a* : 23 (as form of *Parnassius actius frischi*). 1 ♂, 1 ♀ syntypes. Kansu sept. occ., Kan-tschou, Richthofen mont. sept., Nashi Pass. 3000 m. Juli./Co-Type, O. Bang-Haas.

***diabolicus*** Bryk & Eisner, 1929 : 47, figs 1–2 (as subsp. of *Parnassius stubbendorfi*). 4 ♂, 2 ♀ paralectotypes. 2 ♂, Gaolindsy, Mandschurei. 1929./Coll. Eisner, Berlin. 1 ♂, Maoreschan, Mandschurei. 22.vi.1929. 1 ♂, Maoreschan, Mandschurei. 1929./Coll. Eisner, Berlin. 1 ♀, Maoreschan, Mandschurei. 10.vii.1929./Coll Eisner, Berlin. 1 ♀, Maoreschan, Mandschurei. 10.vii.1929.

Lectotype designated by Eisner, 1966*a* : 16 (see Introduction).

***diana*** Bryk, 1934 : 27 (as subsp. of *Parnassius jacquemonti*). 1 ♂, 1 ♀ syntypes. 1 ♂, Central Asia./10.vii.84. 1 ♀, Dschirgetal, Alai mer./10.vii.84.

Described from S. Alai, Dschirgetai.

***dinianus*** Fruhstorfer, 1908*c* : 17 (as subsp. of *Parnassius mnemosyne*). 2 ♂, 3 ♀ syntypes. Digne, Fruhstorfer.

***dirschi*** Bang-Haas, 1938*a* : 21, pl. 2, fig. 14 (as subsp. of *Tadumia simo*). 1 ♂, 1 ♀ syntypes. Kansu occ., Liang-tschou, Richthofen mont. mar. 2500 m. Juli./Co-Type, O. Bang-Haas.

***dis*** Grum-Grshimailo, 1890 : 174 (as var. of *Parnassius nomion*). 1 ♀ syntype. Irkutsk.

Not included by Eisner, 1966*a*. Determined by Eisner as *Parnassius nomion dis* Bryk & Eisner form *dis* Grum-Grshimailo.

***dolabella*** Fruhstorfer, 1904*a* : 29 (as subsp. of *Parnassius delphius*). 1 ♂ syntype. Kaschar, Fruhstorfer.

Currently placed as a synonym of *Koramius delphius infernalis* Elwes.

***dominus*** Bang-Haas, 1934*a* : 109 (as subsp. of *Parnassius imperator*). 1 ♂, 1 ♀ syntypes. Kuku-Nor occ., Alt-Tau, Hsi-king-schan. 2500 m. Ende Juli./Co-Type e Collection Bang-Haas.

Currently placed as a subspecies of *Eukoramius imperator* Oberthür.

Described from Kuku-nor mer. or., Alt Tau (Tau-dshow oder Tauchow), Hsi-King-shan (Tasurethat Gebirge). 2500 m., 15–25 Juli 1933.

***dongalaica*** Tytler, 1926 : 249, pl. IV. fig. 5 (as sp. of *Parnassius*). Holotype ♂. Donga-la, Tibet. 16.000′. 18.vii.1922. (Mt. Everest).

Currently placed as a subspecies (or hybrid?) of *Parnassius epaphus* Oberthür.

***dorriesi*** Warnecke, 1919 : 25 (as ab. of *Parnassius bremeri*). Holotype ♂. Ussuri, Coll. Dörries.

Not included by Eisner, 1966*a*.

***eierhoffi*** Bang-Haas, 1938*a* : 21, pl. 2, fig. 10 (as subsp. of *Koramius cephalus*). 1 ♂, 1 ♀ syntypes. Kansu occ., Liang-tschou, Richthofen mont. 2500 m. Juli./Co-Type, O. Bang-Haas.

***elegans*** Bryk, 1932*a* : 20 (as subsp. of *Koramius delphius*). 1 ♂, 1 ♀ syntypes. Safed Koh. 13,500′. 14.8.1916.

***ella*** Bryk, 1932*c* : 49 (as subsp. of *Kailasius charltonius*). 1 ♂, 2 ♀ syntypes. 1 ♂, 1 ♀, Skoro La. July, 1887. J. H. Leech. 1 ♀, Deosai plains. August, 1887. J. H. Leech.

***elwesi*** Leech, 1893 : 104 (as var. of *Parnassius delphius*). Holotype ♂. How-Kow, Thibet. 10,000′. July–Aug. 1890.

Currently placed as a subspecies of *Koramius cephalus* Grum-Grshimailo.

Described from High Plateau north of Ta-chien-lu, but this specimen is certainly the holotype.

***eos*** Bryk & Eisner, 1934 : 25, figs 5–6 (as subsp. of *Parnassius simo*). 1 ♂, 1 ♀ paralectotypes. Weynänpou, Sining Gebiet, Kansu sept. 4000 m. Mitte Juli.

Currently placed as a subspecies of *Tadumia simo* Gray.

Lectotype designated by Eisner, 1966*a* : 54 (see Introduction).

***epaphoides*** Bryk & Eisner, 1937*a* : 23 (as subsp. of *Parnassius nomion*). 1 ♂ paralectotype. Kansu, Ngämen. 2700 m. 45 km. nordwestl. Lassa. Juli.

Described from Ngämen-Kette, Sining-Gebiet.

Lectotype designated by Eisner, 1966*a* : 36 (see Introduction).

***epaphus*** Oberthür, 1879 : 23 (as sp. of *Parnassius*). Lectotype ♂, 1 ♀ paralectotype. Thibet, Maj. Charlton./Elwes Coll. (Pl. 1, fig. 10.)

Described from Himalaya mountains and Chinese Tartary.

Lectotype designated on p. 5.

***escalerae*** Rothschild, 1909 : 9 (as subsp. of *Parnassius apollo*). 45 ♂, 25 ♀ syntypes. San Ildefonso, Segovia, Spain. vi–vii. 1906. M. de la Escalera.

Described from only 40 ♂, 35 ♀ from San Ildefonso. It is not possible to state which of the specimens constitute the syntypic series.

***esperi*** Bryk, 1922*a* : 15, figs 6–7 (as var. of *Parnassius mnemosyne*). 1 ♂, 1 ♀ paralectotypes. 1 ♂, Torino Mte., Superga. Ende Juni. Gerings, 1913./ex. Coll. Bryk. 1 ♀, Piemont, Torino Mt., Superga, Gerings./ex. Coll. Bryk.

Currently placed as a subspecies of *Parnassius mnemosyne* L.

Lectotype designated by Eisner, 1966*a* : 9 (see Introduction).

***estonicus*** Bryk, 1922 : 5 (as form of *Parnassius mnemosyne*). 1 ♂ paralectotype. Estland, Toila. 5.6.1918. Dr v. Rosen./ex. Coll. Bryk.

Currently placed as a subspecies of *Parnassius mnemosyne*.

Lectotype designated by Eisner, 1966*a* : 8 (see Introduction).

***eugraphica*** Stauder, 1924 : 60 (as form of *Parnassius delphius*). Naryn. VI. 1922. H. Stauder. Not included by Eisner, 1966*a*.

***evansi*** Bryk, 1932 : 5 (as subsp. of *Tadumia imperator*). Holotype ♀. S. E. Thibet, Charap. 14,500′. 5.9.13./W. H. Evans.

Currently placed as a subspecies of *Eukoramius imperator* Oberthür.

***everesti*** Riley, 1922 : 463, pl. XXXVI, figs 7–8 (as subsp. of *Parnassius epaphus*). 4 ♂, 3 ♀ syntypes. Camp N. N. W. of Everest, on moraine shelf above Rongbuk Glacier. 1 ♂, 18.vii.1921. 1 ♂, 6.vii.1921. 1 ♂, 30.vii.1921. 1 ♂, 1 ♀, 2.vii.1921. 1 ♀, 7.vii.1921. 1 ♀, 14.vii.1921.

***expectatus*** Fruhstorfer, 1921*i* : 13. (as subsp. of *Parnassius delius*). 5 ♂, 3 ♀ syntypes. 5 ♂, 1 ♀, Passier. 1920. 1200 m. Prestin. 2 ♀, Passier. 1920. 1200 m. Prestin./Kummersee, Passier. 1150 metres.

Currently placed as a subspecies of *Parnassius phoebus* F.

***fasseliana*** Fruhstorfer, 1921*m* : 41 (as subsp. of *Parnassius mnemosyne*). 2 ♂ syntypes. 1 ♂, Strobnitz, Erzgeb., Fruhstorfer. 1 ♂, 5.vi.1918. Strobnitz bei Ossegg. 800 m. Fassl leg.

Described from Erzgebirge, Nordböhmen, Strobnitz bei Ossegg ca. 800 m. 5.vi.1918.

***finmarchicus*** Rothschild, 1908 : 390 (as subsp. of *Parnassius apollo*). 4 ♂, 1 ♀ syntypes. 2 ♂, 1 ♀ Helsingfors. 2 ♂, Lovisa bei Helsingfors.

***florenciae*** Tytler, 1926 : 251, pl. IV, fig. 9 (as subsp. of *Parnassius delphius*). Holotype ♂. Phup, Hundes. 15,000′. 6. 1906./Tytler Collection.

Currently placed as a subspecies of *Koramius delphius* Eversmann.

***frischi*** Bang-Haas, 1938*a* : 23, pl. 2, figs 7–8 (as subsp. of *Parnassius actius*). 1 ♂, 1 ♀ syntypes. Kansu sept, occ., Kan-tschou, Richthofen mont. sept., Nashi Pass. 3000 m. Juli./Co-Type, O. Bang-Haas.

***frivaldszkyi*** Bang-Haas, 1928 : 60 (as subsp. of *Parnassius szechenyi*). 1 ♂, 1 ♀ syntypes. 1 ♂, Kansu sept., westl. Liangtschou, Shekou, Richthofen mont. 3000 m. August./Co-Type e Collection Bang-Haas. 1 ♀, Richthofen Gbg., westl. Liang-tschou, Kansu sept., China. Juli. 2500 m./Co-Type e Collection Bang-Haas.

Currently placed as a subspecies of *Koramius szechenyi* Frivaldszky.

Described from China sept. occ., Kansu, Richthofen mont., südwestl. Liang-tschou.

***fruhstorferi*** Turati, 1909 : 34, pl. I, figs 1–2 (as subsp. of *Parnassius mnemosyne*). 2 ♂ syntypes. Italia centr., Mt. Autore. 1400′. 26.6.1908. Geo. C. Krüger. Mus. Turati E.

***gabrieli*** Bryk, 1934 : 28 (as subsp. of *Parnassius nomion*). Holotype ♀. Burchan-Budda, Chatu. 1000′. 27. vii. Koslov.

***generosus*** Fruhstorfer, 1920 : 28 (as subsp. of *Parnassius apollo*). 1 ♂ syntype. Tessin, Mt. Generosa. m. 1200. G. C. Krüger./Fruhstorfer Coll.

***glacialis*** Butler, 1866 : 50 (as sp. of *Parnassius*). 1 ♂ syntype. Japan, Hakodadi./Japan. 66.15. (Pl. 1, fig. 3).

***gloriosus*** Fruhstorfer, 1904 : 309 (as subsp. of *Parnassius apollonius*). 1 ♂, 1 ♀ syntypes. Alexander-Geb., Fruhstorfer.

***grossei*** Bryk, 1925 : 30 (as var. of *Parnassius mnemosyne*). 1 ♂, 1 ♀ paralectotypes. 1 ♂, Galizien, Hodow./Recd. in exchange from C. Eisner. 1 ♀, Galizien, Hodow, leg. Grosse./ex. Coll. Bryk./Recd. in exchange from C. Eisner.

Currently placed as a subsp. of *Parnassius mnemosyne* L.

Lectotype designated by Eisner, 1966*a* : 10 (see Introduction).

***guadarramensis*** Fruhstorfer, 1909 : 151 (as subsp. of *Parnassius apollo*). 3 ♂, 2 ♀ syntypes. Spanien, Castilien, Fruhstorfer.

Described from Sierra de Guadarrama, nördlich von Madrid, but these specimens are certainly part of the original series.

***gyaella*** Eisner, 1932 : 68 (as subsp. of *Parnassius epaphus*). 4 ♂, 4 ♀ paralectotypes. Gya-Ladak, Taglang Pass. 5000 m. 15–30. Juli. Co-Type e Collection Bang-Haas.

Lectotype designated by Eisner, 1966*a* : 32 (see Introduction).

***gylippos*** Fruhstorfer, 1903 : 45 (as sp. of *Parnassius*). 1 ♂ syntype. Aksu, Fruhstorfer.

Currently placed as a subspecies of *Tadumia simo* Gray.

Described from Umgebung von Aksu, Chines. Turkestan.

(Emend. *gylippus* Fruhstorfer, Bryk, 1935 : 669.)

***hades*** Bryk, 1932 : 5 (as subsp. of *Koramius acdestis*). Holotype ♂. Tibet, Thung-La. 14,000 ft. 15.vii.1921. A. F. R. Wollaston.

***hansi*** Bryk, 1923 : 212. (as nomen nov. for *Parnassius delius hermiston* Fruhstorfer, 1922*c* : 11 [nomen praeocc.]). 1 ♂, 1 ♀ syntypes. G. Glockner, Fruhstorfer.

Currently placed as a subspecies of *Parnassius phoebus* F.

***hardwickii*** Gray, 1831 : 32 (as sp. of *Parnassius*). 1 ♂ syntype. Nepaul. Nepal, Hardwicke Bequest. (Pl. 1, fig. 6.)

Currently placed as a species of *Lingamius* Bryk.

(Emend. *hardwickei* Gray, Haase, 1892 : 111.)

***hel*** Eisner, 1956*a* : 243, pl. III, figs 1–6 (as subsp. of *Parnassius clodius*). 4 ♂ paratypes. 1 ♂, leg. D. Frenchin. Stevens Pass, Cascade Mts. 4000–4500′. Wash., U.S.A. 9.7.1952. 2 ♂, Museum Leiden. Stevens Pass. 4000′. Wash. 21.viii.1955. R. Nagle. 1 ♂ Berne, Wash. 7.12.42. E. C. Johnston.

***helias*** Fruhstorfer, 1923 : 55 (as subsp. of *Parnassius apollo*). 3 ♂, 4 ♀ syntypes. 1 ♂, Curfisten. 23.iv.1920. Fruhstorfer. 2 ♂, 4 ♀, Säntis, Fruhstorfer.

***heliconius*** Bryk, 1932*c* : 47 (as subsp. of *Parnassius stubbendorfi*). 6 ♂, 2 ♀ syntypes. Chikuan Shan, Antung-Mukden (Dr Martin). 3 ♂, 26.5.1913. 1 ♂, 28.5.1913. 1 ♂, 30.5.1913. 1 ♂, 1 ♀, 25.5.1913. 1 ♀, 31.5.1913.

***heliophilus*** Fruhstorfer, 1921*c* : 53 (as subsp. of *Parnassius apollo*). 36 ♂, 6 ♀ syntypes. 1 ♂, Fusio, Fruhstorfer. 1 ♂, Fusio. 14.7.1910. 3 ♂, Lavizzara. 16.7.1910. 25 ♂, Val. Bavona. 30.6.18. 600 m. Fruhstorfer. 6 ♂, 1 ♀, Val. Maggina. 12–14. vii. 8–1200 m. 1 ♀, V. Bosco. 2 ♀, Val Lavizzara. 1 ♀, Fusio. 10.7.06. 1 ♀, Val Bedretto. 1919. Fruhstorfer.

***hermiston*** Fruhstorfer, 1921*f* : 89 (as subsp. of *Parnassius apollo*). 1 ♂ syntype. Schipka, Fruhstorfer.

Described from Balkan, Schipkapass, ca. 1300 m.

***hermiston*** Fruhstorfer, 1922*c* : 11. See *hansi* Bryk.

***hillensis*** Bang-Haas, 1915*a* : 176, pl. V, fig. 29 (as race of *Parnassius epaphus*). 1 ♂, 1 ♀ syntypes. Bashahr State, Stargyugsa. 5000 m. August./Co-Type./Staudinger, Bang-Haas, Blasewitz.

Currently placed as a subspecies of *Parnassius epaphus* Oberthür.

***himalayanus*** Riley, 1922 : 463, pl. XXXVI, fig. 6 (as subsp. of *Parnassius epaphus*). 2 ♂, 1 ♀ syntypes. 1 ♂, Tibet, Chog La. 17,000 ft. 8.viii.1921. A. F. R. Wollaston./Everest Exp. 1 ♂, Aug. 6.1921. Thibet, camp abt. 5 m. E. of Everest. Grassy Country. G. H. Bullock 1 ♀, Tibet, Rongshar Valley. 14,000 ft. 18.viii.1921. A. F. R. Wollaston./Everest Exp.

***himalayensis*** Elwes, 1886 : 30 (as var. of *Parnassius actius*). Lectotype ♂, 2 ♂, 4 ♀ paralectotypes. Lahoul. 12,000 ft., Young. 3 ♂, 2 ♀, 8.84. 1 ♀, 7.8.84. 1 ♀, 14.8.84. (Pl. 1, fig. 4.)
Currently placed as a subspecies of *Parnassius jacquemontii* Boisduval.
Lectotype designated on p. 6.

***hinducucica*** Bang-Haas, 1934 : 7 (as subsp. of *Parnassius epaphus*). 2 ♂ syntypes. Kashmir sept., Chitral, Hindukush mont., Karambar Pass. 4,500 m./Co-Type e Collection Bang-Haas.

***hingstoni*** Bryk, 1932*b* : 31, figs 2–3 (as subsp. of *Tadumia simo*). 3 ♂, 1 ♀ syntypes. Tibet, Phuse la. 16,000 ft. 19.vi.1934. R. W. G. Hingston./Everest Exp.

***hodja*** Avinoff, 1913 : 18, pl. II, fig. 6 (as natio of *Parnassius delphius staudingeri*). 1 ♂ syntype. 8.vii.1912. Hodja Barku. 12000 ft.
Currently placed as a subspecies of *Koramius delphius* Eversmann.

***hohlbecki*** Avinoff, 1913 : 13, pl. II, figs 2–3 (as subsp. of *Parnassius boedromius*). 3 ♂ syntypes. Alexander Mts., Gau-Bussar. 12,000–13,000 ft. 1 ♂, 16.vii.1910. 1 ♂, 23.vii.1910. 1 ♂, 24.vii.1910.
Currently placed as a subspecies of *Tadumia simo* Gray.

***hungaricus*** Rothschild 1909 : 2 (as subsp. of *Parnassius mnemosyne*). 2 ♂ syntypes. 1 ♂, Kronstadt, Transsylvania. 1 ♂, Herkulesbad. 6. July 1907. W. R. & E. H.

***hunnyngtoni*** Avinoff, 1915 : 351 (as sp. of *Parnassius*). 1 ♂, 1 ♀ syntypes. 1 ♂, Kangma, S. Tibet. 5.11. Nat. Collr. 1 ♀, S. Tibet. 5.10. Nat. Collr.
Currently placed as a subspecies of *Tadumia acco* Gray.
(Emend. *hannyngtoni* Avinoff, Bryk, 1932*b* : 32.)

***hunza*** Grum-Grshimailo, 1888 : 303 (as var. of *Parnassius stoliczkanus*). 1 ♂, 1 ♀ syntypes. Hindukusch or./Coll. Gr. Gr.
Currently placed as a subspecies of *Koramius delphius* Eversmann.

***hunzaica*** Tytler, 1926 : 250, pl. IV, fig. 2 (as subsp. of *Parnassius discobolus*). 12 ♂, 10 ♀ syntypes. Misgar, Hunza. 8.24.
Currently placed as a subspecies of *Parnassius jacquemontii* Boisduval.

***idahoensis*** Bryk & Eisner, 1931 : 5, figs 4–5 (as subsp. of *Parnassius smintheus*). 1 ♂ paralectotype. Wallace, Idaho. 4.7.1930. ex. C. Avinoff.
Currently placed as a subspecies of *Parnassius phoebus* F.
Lectotype designated by Eisner, 1966*a* : 25 (see Introduction).

***illustris*** Grum-Grshimailo, 1888 : 304 (as var. of *Parnassius delphius*). 4 ♂, 3 ♀ syntypes. 3 ♂, 2 ♀, Aramkungei, Transalai./Gr. Gr. 1 ♂, Transalai m./Ex speciminibus typicis. 1 ♀, Ex speciminibus typicis.
Currently placed as a subspecies of *Koramius delphius* Eversmann.

***impunctata*** Austaut, 1899 : 154 (as var. of *Parnassius jacquemontii*). 1 ♂ syntype. India, Sikkim. ex. coll. Fruhstorfer./Coll. Austaut.
Currently placed as a subspecies of *Parnassius jacquemontii* Boisduval.

***incredibilis*** Bryk & Eisner, 1932*f* : 99 (as subsp. of *Parnassius clodius*). 1 ♂ syntype. St. Elie mons./Elwes Coll.

***infumata*** Austaut, 1891 : 180 (as var. of *Parnassius delphius*). 1 ♂, 1 ♀ syntypes. Plateau du Pamir./Coll. Austaut.
Currently placed as a subspecies of *Koramius delphius* Eversmann.

***inornata*** Wheeler, 1903 : 56 (as ab. of *Parnassius delius*). 1 ♂ syntype. Simplon. vii. 9. 01./ G. W. Wheeler.
Not included by Eisner, 1966*a*.

***intermedius*** Rothschild, 1909 : 19 (as subsp. of *Parnassius imperator*). 2 ♀ syntypes. Pembu Pass, 12 Miles North of Lhasa. viii.1904 (N. V. L. Rybot).
Currently placed as a subspecies of *Eukoramius imperator* Oberthür.

***interposita*** Herz, 1903 : 62 (as var. of *Parnassius delius*). 1 ♂ syntype. Janatal (O. Herz).
Currently placed as a subspecies of *Parnassius phoebus* F.

***irmae*** Bryk, 1932 : 4, fig. 2 (as subsp. of *Tadumia imperator*). Holotype ♂. S. Tibet, Trum La. 16,000 ft. 10.8.22.
Currently placed as a subspecies of *Eukoramius imperator* Oberthür.

**janseni** Bang-Haas, 1938 : 57 (as subsp. of *Parnassius orleans*). 1 ♂, 1 ♀ syntype. China sept. occ., Pullow mont., Min-schan occ. 3500 m. Juli./Co-Type e Collection Bang-Haas.

**jelicus** Fruhstorfer, 1921*f* : 87 (as subsp. of *Parnassius apollo*). 1 ♂ syntype. Serbien, Jelika Pass, Fruhstorfer.

**jocundula** Stauder, 1924*a* : 17 (as form of *Parnassius apollo*). 1 ♂ syntype. Austria sup., Grunan m. 15.vii.1922. H. Stauder.

Not included by Eisner, 1966*a*.

**johanna** Bryk, 1932*d* : 67 (as subsp. of *Parnassius orleans*). 33 ♂, 11 ♀ syntypes. Taipaishan, Shensi, China. July, 1905.

**jupiterius** Bang-Haas, 1933 : 262 (as subsp. of *Parnassius mercurius*). 2 ♂ syntypes. Kansu mer. or., Min, Minschan or. 3000 m. Juli./Co-Type e Collection Bang-Haas.

Currently placed as a subspecies of *Parnassius jacquemontii* Boisduval.

**juvavus** Kolar, 1922 : 42 (as race of *Parnassius apollo*). 1 ♂, 1 ♀ syntypes. 1 ♂, Tannengebirge, Ofenrinne. 23.7.1917. 1400 m. E. Hoffman. 1 ♀, Salzburg, Tannengeb., Ofenlechrinne, E. Hoffman. 1300 m. 1.viii.1915.

Currently placed as a subspecies of *Parnassius apollo* L.

**kangraensis** Bryk & Eisner, 1932*a* : 23, figs 7–8 (as subsp. of *Parnassius jacquemontii*). 2 ♂ paralectotypes. Rohtang Pass, Kangra, India sept. 4053 m. Juli.

Lectotype designated by Eisner, 1966*a* : 30 (see Introduction).

**kansuensis** Bryk & Eisner, 1931*b* : 7, figs 6–7 (as subsp. of *Parnassius szechenyi*). 1 ♂, 1 ♀ paralectotypes. 1 ♂, Kansu sept. occ., Hsining, Nanshing mont., Tatung. 3500 m. August. 1 ♀, Kansu sept. occ., Hsining, Nanschan mont., Tatung. 3500 m. Juli.

Currently placed as a subspecies of *Koramius szechenyi* Frivaldszky.

Described from Nanshan, Tatung montes, Kansu, Lassa.

Lectotype designated by Eisner, 1966*a* : 46 (see Introduction).

**kardakoffi** Bryk & Eisner, 1930*a* : 7, figs 1–2 (as subsp. of *Parnassius acdestis*). 1 ♂, 3 ♀ paralectotypes. Geröllzone. 3200–3700 m. Kungei-Ala-Tau, leg. Jonoff. 1 ♂, 17.vii.1929./ Coll. Eisner, Berlin. 1 ♀, 17.vii.1929./Received in exchange from C. Eisner. 1 ♀, 18.vii.1929./ Coll. Eisner, Berlin. 1 ♀, 18.vii.1929.

Currently placed as a subspecies of *Koramius patricius* Niepelt.

Lectotype designated by Eisner, 1966*a* : 48 (see Introduction).

**karjala** Bryk, 1911 : 37, figs 1–4 (as subsp. of *Parnassius mnemosyne*). 1 ♀ paralectotype. Myllykick. 1911./Coll. Eisner, Berlin.

Lectotype designated by Eisner, 1966*a* : 8 (see Introduction).

**kjoengsoengensis** Bryk, 1932*c* : 47 (as subsp. of *Parnassius stubbendorfi*). 4 ♂, 2 ♀ syntypes. 3 ♂, 2 ♀, Shiotsufluss, Kjongsong, Korea sept. or. 1500 m. Juli. 1 ♂, Umgebung Sei Shin, Nordkorea. 1929. leg. Jankowsky./Received in exchange from C. Eisner.

**kohibaba** Clench & Shoumatoff, 1956 : 179 (as subsp. of *Parnassius delphius*). 2 ♂, 2 ♀ paratypes. Mt. Shah Fuladi, Surutu, Afghan slopes. 3rd. Danish Exp. Central Asia. 1 ♀, Aug. 10. 1 ♂, 2 ♀, Aug. 11.

Currently placed as a subspecies of *Koramius delphius* Eversmann.

**koreana** Verity, 1907 : 101, 1911 : 322, pl. LXV, figs 19–20 (as var. of *Parnassius stubbendorfi*). 1 ♂, 1 ♀ syntypes. 1 ♂, Korea, S. W. Coast, Liet. Gunn. 1 ♀, Korea, S. W. Coast. 6.6.84.

Currently placed as a subspecies of *Parnassius stubbendorfi* Ménétriés.

**koshoensis** Eisner, 1939 : 39 (as subsp. of *Parnassius nomion*). 2 ♂, 1 ♀, paralectotypes. Corea sept., Heianhokudo, Kosho. Juli.

Lectotype designated by Eisner, 1966*a* : 34 (see Introduction).

**kricheldorffi** Eisner, 1928 : 309, figs. 1–2 (as subsp. of *Parnassius apollo*). 7 ♂, 6 ♀, paralectotypes. Asturien, Picos de Europa. 1800–2000 m 20–28.vii.1928. 5 ♂, 5 ♀, Coll. Eisner, Berlin. 2 ♂, 1 ♀, Co-Type e Collection Bang-Haas.

Lectotype designated by Eisner, 1966*a* : 41 (see Introduction).

**kumaonensis** Riley, 1926 : 277, pl. II, fig. 3 (as subsp. of *Parnassius delphius*). Holotype ♂. N. Kumaon, Shillung. 12,500 ft. 7.vii.1924. H. G. Champion.

Currently placed as a subspecies of *Koramius delphius* Eversmann.

***lacinia*** Hemming, 1934 : 198 (see *altaica* Verity).

***lampidius*** Fruhstorfer, 1903 : 44 (as subsp. of *Parnassius delphius*). 1 ♀, syntype. Sikkim, Regenzeit, Fruhstorfer.

Currently placed as a subspecies of *Koramius acdestis* Grum-Grshimailo.

***leimdoerfferi*** Bryk, 1935 : 450 (as subsp. of *Parnassius apollo*). 1 ♂, 1 ♀, syntypes. Jugo Slavia, Fiume, Cirkvenica Distr. Mrs de M. Leathes.

***leovigildus*** Fruhstorfer, 1909 : 151 (as subsp. of *Parnassius apollo*). 11 ♂, 2 ♀, syntypes. Digne, Fruhstorfer.

***levantinus*** Rothschild, 1908 : 390 (as subsp. of *Parnassius apollo*). 1 ♂, 1 ♀ syntypes. Aintab.

***liliput*** Bryk, 1932*b* : 32, figs 4–5 (as subsp. of *Tadumia hannyngtoni*). 3 ♂, 3 ♀ syntypes. 1 ♂, Tibet, Dongka-La. 16,000 ft. 19.vii.1922. E. F. Norton. 1 ♂, Tibet, Pang La. 17,000′. 9.v.1924. Maj. R. W. G. Hingston. 1 ♂, Tibet, Rongbuk. 16,000 ft. 15.v.1924. Maj. R. W. G. Hingston. 1 ♀, Tibet, Phuse La. 16,000 ft. 19.vi.1924. Maj. R. W. G. Hingston. 1 ♀, Tibet, Pang La. 17,000 ft. 28.iv.1922. T. G. Longstaff. 1 ♀, Tibet, Lamna La. 17,000 ft. 17.vi.1924. Maj. R. W. G. Hingston.

***linnei*** Bryk, 1913 : 34 (as var. of *Parnassius apollo*). 8 ♂, 9 ♀ paralectotypes. 1 ♂, Torsburg. 1912. vii. 1 ♂, Torsburg, Gotland, (F. Bryk). 2 ♂, Thorsburgen. 11.vii.1912. 1 ♂, 19. vii. Torsburg, leg. F. Bryk. 1912. 3 ♂, 2 ♀, 21. vii. Torsburg, leg. F. Bryk. 1 ♀, Gotland, Slite. 8.vii.1912. 1 ♀, Gotland, Sjonhem. 14.vii.1912. 2 ♀, Gotland, Kräklingbo. 15. Juli. 1 ♀, 17. vii. Torsburg, leg. F. Bryk. 1912. 1 ♀, Thorsburg. 19.vii.1912. 1 ♀, Gotland, Slite. 8. vii.

Currently placed as a subspecies of *Parnassius apollo* L.

Lectotype designated by Eisner, 1966*a* : 38 (see Introduction).

***liupinschani*** Bang-Haas, 1934 : 7 (as subsp. of *Parnassius nomion*). 1 ♀ syntype. Kansu mer., Tsing-schiu, Liu-pin-schan. 2000 m. Juli./Co-Type e Collection Bang-Haas.

Described from Prov. Schensi, Lung, (107 ö. L., 35 n. Br.) Südausläufer des Liupin Gebirges, Juli, 2000 m. Prov Kansu mer. or., Tsingschui.

***liptauensis*** Peschke & Eisner, 1932 : 249 (as subsp. of *Parnassius apollo*). 1 ♂, 1 ♀ paralectotypes. Lipt. Alpen. 28.vii.1932./Jalovec-tal, 550 m.

Lectotype designated by Eisner, 1966*a* : 39 (see Introduction).

***lobnorica*** Bryk, 1934*a* : 32 (as subsp. of *Parnassius orleans*). Holotype ♀. ex. Coll. Christoph. Lob-Nor, Grum.

***lorimeri*** Tytler, 1926 : 252 pl. IV. fig. 10 (as subsp. of *Parnassius simo*). 1 ♀ syntype. Kine-Kish Pass, Gilgit. 14,500′. 25.8.1921.

Currently placed as a subspecies of *Tadumia simo* Gray.

***lucifer*** Bryk, 1932 : 6 (as subsp. of *Koramius acdestis*). Holotype ♂. Sikkim, Gyamtshona. 16,500′. 18.6.1922.

***lumen*** Eisner, 1968 : 12, pl. 2, figs 1–3 (as subsp. of *Parnassius bremeri*). 2 ♂, 1 ♀ paratypes. Andong, Central Korea. 30.v.1967. leg. S. Pak.

***luminosa*** Bang-Haas, 1938*a* : 21 (as subsp. of *Koramius szechenyii*). 1 ♂, 1 ♀ syntypes. Kansu occ., Liang-tschou, Richthofen mont. mar. 2500 m. Juli./Co-Type, O. Bang-Haas.

***lux*** Eisner, 1969*a* : 109, pl. 1, figs 1–2 (as subsp. of *Koramius acdestis*). Holotype ♂, 1 ♀ paratype. Tibet, Jung-jung Khola. 7.vii.1953. J. B. Tyson. 1 ♂, 16,000 ft. 1 ♀, 15,500 ft.

***macdonaldi*** Rothschild, 1918 : 256 (as subsp. of *Parnassius delphius*). 12 ♂, 7 ♀ syntypes. Yatung, Tibet. 12-14,000 ft. (D. Macdonald).

Currently placed as a subspecies of *Koramius acdestis* Grum-Grshimailo.

***mamaievi*** Bang-Haas, 1915 : 98 (as form of *Parnassius stenosemus*). 1 ♂ syntype. Schamn, Unter Ladak. August.

Currently placed as a subspecies of *Koramius delphius* Eversmann.

***martiniheringi*** Bryk & Eisner, 1930 : 1, figs I–IV (as subsp. of *Parnassius simo*). 4 ♂ paralectotypes. Geröllzone. 3,300–3,700 m. Kungei-Ala-Tau, leg. Jonoff./Coll. Eisner, Berlin. 2 ♂, 27.vii.1929. 2 ♂, 23.vii.1929.

Currently placed as a subspecies of *Tadumia simo* Gray.

Lectotype designated by Eisner, 1966*a* : 55 (see Introduction).

***matuta*** Bryk, 1922*c* : 20 (as subsp. of *Parnassius mnemosyne*). 1 ♂, 1 ♀ paralectotypes. 1 ♂, Mte. Authion bei Sospel. 1300 m. Gerings. 1913./ex. Coll. Bryk. 1 ♀, Mte. Authion. 1300 m. Juni. 1913. Gerings./ex Coll. Bryk.

Currently placed as a subspecies of *Parnassius mnemosyne* L.

Lectotype designated by Eisner, 1966*a* : 12 (see Introduction).

***maui*** Bryk, 1915 : 172 (as var. of *Parnassius eversmanni*). [Staudinger and Bang-Haas (i.l.), 1911, *Lep. Liste* 55 : 4.] 4 ♂, 3 ♀ syntypes. Tjutju-ho, 400 km. north of Wladiwostok. 1909. W. Mau.

Currently placed as a subspecies of *Parnassius eversmanni* Ménétriés.

***maureri*** Bryk & Eisner, 1935 : 82 (as subsp. of *Parnassius tianschanicus*). 1 ♂ paralectotype. Hissar Geb. Juni.

Lectotype designated by Eisner, 1966*a* : 29 (see Introduction).

***maximilianus*** Fruhstorfer, 1909 : 150 (as race of *Parnassius apollo*). 2 ♀ syntypes. Amergau, Fruhstorfer.

Currently placed as a subspecies of *Parnassius apollo* L.

Described from Oberbayern, Oberammergau.

***maximinus*** Staudinger, 1891 : 158 (as var. of *Parnassius delphius*). 1 ♂ syntype. Ex speciminibus typicis.

Currently placed as a subspecies of *Koramius delphius* Eversmann.

***meinhardi*** Sheljuzko, 1924 : 57 (as subsp. of *Parnassius apollo*). 1 ♂, 1 ♀ syntypes. Petropavlovsk. 26.vi.1904.

***melanica*** Verity, 1911 : 314, pl. LXIII, fig. 18 (as ab. of *Parnassius delius* var. *intermedius*). Holotype ♀. Altai, Kuraipan. 7,500′. 25.7. H. J. Elwes.

Not included by Eisner, 1966*a*.

***melaniticus*** Bang-Haas, 1915*a* : 173, pl. V, fig. 2 (as var. of *Parnassius actius*). 1 ♂, 1 ♀ syntypes. Kutscha mont., Thianschan or. Juli. 3500 m.

Currently placed as a subspecies of *Parnassius actius* Eversmann.

Described from Tianschan or. mer., Kourgak Taon, Kutscha Gebirge, nord-westlich Karaschahr.

***mercurius*** Grum-Grshimailo, 1891 : 445 (as sp. of *Parnassius*). 1 ♂, 1 ♀ syntypes. 1 ♂, Coll. Gr. Gr., Amdo. 1890. 1 ♀, Amdo. Liang-tcha-sien, Sinin Alps. 12,300 ft. 22.6.90. Coll. Gr. Gr.

Currently placed as a subspecies of *Parnassius jacquemontii* Boisduval.

***mesoleucus*** Fruhstorfer, 1908*c* : 18 (as possible replacement name for *Parnassius mnemosyne melaina* Honrath); 1908 : 12 (as subsp. of *Parnassius mnemosyne*). 4 ♂, 3 ♀ syntypes. 2 ♂, N. Ungarn, Fruhstorfer. 2 ♂, 3 ♀, Nord Ungarn, Fruhstorfer.

***minchani*** Bryk & Eisner, 1932*b* : 26 (as subsp. of *Parnassius nomion*). 4 ♂, 1 ♀ paralectotypes. Kansu mer. Min-schan, Tauho. 2500 m. Juli./Co-Type e Collection Bang-Haas.

(emend. *minschani* Bryk & Eisner, Bryk & Eisner, 1932*d* : 42).

Lectotype designated by Eisner, 1966*a* : 35 (see Introduction).

***minuscula*** Verity, 1911 : 312, pl. LXII, fig. 7 (as ab. of *Parnassius apollo*). Holotype ♂. Dourbes. 81. C./Elwes Coll.

Currently placed as a form of *Parnassius apollo* L.

***mixtus*** Fruhstorfer, 1922*b* : 23 (as subsp. of *Parnassius mnemosyne*). 5 ♂, 12 ♀ syntypes. 1 ♂, Binn. 12.7.12. 2 ♂, 1 ♀, Berisal. 16.6.16. Fruhstorfer. 2 ♂, 11 ♀, Lötschental. vii. 1600 m. H. Fruhstorfer.

***moelleri*** Bingham, 1907 : 130, fig. 34 (as race of *Parnassius simo*). 1 ♂, 1 ♀ syntypes. Sikkim. vii. 1902. C. White. Bingham Coll. 1 ♂, 16,000–19,300′. 1 ♀, 19,300′.

Currently placed as a synonym of *Tadumia simo acconus* Fruhstorfer.

***musageta*** Grum-Grshimailo, 1891 : 446 (as var. of *Parnassius imperator*). 3 ♂, 1 ♀ syntypes. 1 ♂, Amdo./Chuan-che. 13.vii.1890./Coll. Gr. Gr. 1 ♂, Chuan-che. 14.vii.1890./Coll. Gr. Gr. 1 ♂, 1 ♀, Ex speciminibus typicis.

Currently placed as a subspecies of *Eukoramius imperator* Oberthür.

***nanchanica*** Austaut, 1899*a* : 285 (as var. of *Parnassius sikkimensis*). 1 ♂ paralectotype. Nan-chan.

Currently placed as a subspecies of *Parnassius epaphus* Oberthür.

Lectotype designated by Bernardi & Viette, 1966 : 164.

***nankingi*** Bang-Haas, 1927 : 5, pl. I, fig. 3 (as subsp. of *Parnassius stubbendorfi*). 2 ♂ syntypes. Berg Paoschan b. Nanking, China sept. or. April./Co-Type e Collection Bang-Haas.

Currently placed as a subspecies of *Parnassius glacialis* Butler.

Described from China or., Kiangsu, Berg Paoschan bei Nanking, gef. von Höne, April 1925.

***narynus*** Fruhstorfer, 1908*a* : 51 (as subsp. of *Parnassius apollonius*). 1 ♂ syntype. Naryn, 4.vi.04./Turkestan, Fruhstorfer.

***navasi*** Bryk, 1934 : 28 (as subsp. of *Parnassius apollo*). 15 ♂, 4 ♀ syntypes. Aragon, Orihuela, m. 1700. Querci. 2 ♂, 6.vii.24. 1 ♂, 8.vii.24. 1 ♂, 9.vii.24. 1 ♂, 10.vii.24. 1 ♂, 11.vii.24. 1 ♂, 12.vii.24. 1 ♂, 13.vii.24. 1 ♂, 15.vii.24. 2 ♂, 16.vii.24. 1 ♂, 17.vii.24. 1 ♂, 18.vii.24. 1 ♂, 19.vii.24. 1 ♂, 20.vii.24. 1 ♀, 6.vii.24. 1 ♀, 7.vii.24. 2 ♀, 26.vii.24.

***nicevillei*** Avinoff, 1915 : 355, pl. LIII, figs 1–2 (as subsp. of *Parnassius delphius*). 2 ♂ syntypes. 1 ♂, Burzil. 13000′. Kashmir. vii. Avinov. 1 ♂, Burzil Pass, Kashmir. 13,000′. July 1913.

Currently placed as a subspecies of *Koramius delphius* Eversmann.

***nigerrima*** Bang-Haas, 1938*a* : 23 (as form of *Parnassius actius frischi*). 1 ♀ syntype. Kansu sept. occ., Kan-tschou, Richthofen mont. sept., Nashi Pass. 3000 m. Juli./Co-Type, O. Bang-Haas.

***nigrescens*** Wheeler, 1903 : 57 (as ab. of *Parnassius delius*). 2 ♀ syntypes. Languard Alp. 5.8.01./G. Wheeler.

Not included by Eisner, 1966*a*.

***nigromaculata*** Niepelt, 1916 : 118 (as var. of *Parnassius tenedius*). Holotype ♂. Altai, Collection Niepelt.

Not included by Eisner, 1966*a*.

***nirius*** Moore, 1902 : 108, pl. 407, figs 1–1a (as sp. of *Parnassius*). 1 ♂, 1 ♀ syntypes. 1 ♂, Niri Lumdo in Karnag./Dr Stoliczka, Ladak, Thibet. 12–13,000 ft. 1 ♀, Skoro La. July 1887. J. H. Leech.

Currently placed as a subspecies of *Parnassius epaphus* Oberthür.

***nivalis*** Grose Smith, 1908 : 116 (as sp. of *Parnassius*). Holotype ♂. Naryn R., Tsian Shan./Ex. Grose Smith. 1910.

Not included by Eisner, 1966*a*, but placed by Bryk, 1935, as a form of *Parnassius mnemosyne giganteus* Staudinger.

***nivatus*** Fruhstorfer, 1906 : 138 (as subsp. of *Parnassius apollo*). 13 ♂, 7 ♀ syntypes. Neuveville. Juni 1906. H. Fruhstorfer.

Described from Vorberge des Chasseral bei Neuveville.

***noricanus*** Kolar, 1922 : 42 (as local race of *Parnassius apollo*). 2 ♂, 1 ♀ paralectotypes. 1 ♂, Salzburg, Mauterndorf. 2.v.1920./leg. Spannring. 1 ♂, Salzburg, Lungau, Mauterndorf. 9.viii.1920./leg. Spannring. 1 ♀, Salzburg, Lungau. 1135 m. Mauterndorf. 12.vii.1915./leg. F. Kiedel, 1915.

Currently placed as a subspecies of *Parnassius apollo* L.

Lectotype designated by Eisner, 1966*a* : 43 (see Introduction).

***novarae*** Oberthür, 1891 : 7 (as ab. of *Parnassius apollo*). Holotype ♂. Silesia.

Not included by Eisner, 1966*a*.

***nubilosus*** Christoph, 1873 : 19 (as var. of *Parnassius mnemosyne*). 1 ♂ syntype. Hyrcania./Hadshabad./Coll. Gr. Gr.

Currently placed as a subspecies of *Parnassius mnemosyne* L.

***oberthuri*** Austaut, 1895 : 247 (as var. of *Parnassius poeta*). 1 ♂, 1 ♀ syntypes. Thibet, Tchang-Kou, Chasseurs Chinois. Ete, 1892./Coll. Austaut.

Currently placed as a form (or subspecies?) of *Parnassius epaphus* Oberthür.

***obliterata*** Verity, 1911 : 317, pl. LIX, fig. 1 (as ab. of *Parnassius delphius* var. *stoliczkanus*). Holotype ♀. Kulu.

Not included by Eisner, 1966*a*.

***obscurata*** Verity, 1911 : 303, pl. LVIII, fig. 10 (as form of *Parnassius bremeri*). Holotype ♀. Raddefka.

Not included by Eisner, 1966*a*.

***olympiacus*** Kolar & Rebel, 1934 : 366, pl. 1, figs 1–2, pl. 2, fig. 3 (as var. of *Parnassius apollo*). 1 ♂ syntype. Olymp. 2200 m. vii. 1934. coll. Dr H. Kolar.

Currently placed as a subspecies of *Parnassius apollo* L.

***omegascriptum*** Stauder, 1924 : 59 (as form of *Parnassius delphius*). 1 ♂ syntype. Naryn. v. 1922. H. Stauder.

Not included by Eisner, 1966*a*.

***omotimoius*** Fruhstorfer, 1921*f* : 87 (as subsp. of *Parnassius apollo*). 1 ♀ syntype. Vitosch. Juli. Sofia, Bulgarien./Fruhstorfer Coll.

***oravensis*** Eisner & Zelny, 1969 : 112, pl. 3, figs 1–4 (as subsp. of *Parnassius apollo*). 4 ♂, 2 ♀ paratypes. 1 ♂, Kozinska. 27.7.67. 1 ♂, Slovakei, Kozinska. 7.7.68. Zelny. 1 ♂, Kozinska, Arvaer Magura, 8.8.1966. leg. Zelny. 1 ♂, Slovakia bor., Arvaer Magura, Kozinska, Jan Zelny lgt. 1 ♀, Kozinska. 8.8.66. 1 ♀, Slovakia bor., Arv. Magura, Zazriva. 12.7.67. Jan Zelny lgt.

***orientalis*** Verity, 1911 : 321, pl. LXV, figs 12–13 (as race of *Parnassius mnemosyne* var. *gigantea*). 1 ♂, 1 ♀ syntypes. 1 ♂, Alexandr. mont./Coll. Gr. Gr. 1 ♀, Coll. Gr. Gr.

Currently placed as a subspecies of *Parnassius mnemosyne* L.

***ornatus*** Bang-Haas, 1915 : 93 (as var. of *Parnassius actius*). 3 ♂, 4 ♀ syntypes. 2 ♂, 2 ♀, Karakorum mont., Schahidulla, Chines Tartarei. 4000 m. Ende Juni./Co-Type e Collection Bang-Haas. 1 ♂, 1 ♀, Schahidulla, Chotan mer./Staudinger, Bang-Haas, Blasewitz. 1 ♀, Schahidulla, Chotan mer. Juni. 4500 m.

Currently placed as a subspecies of *Parnassius actius* Eversmann.

***orotschonica*** Bang-Haas, 1927 : 10, pl. 1, figs 7–8 (as subsp. of *Parnassius bremeri*). 2 ♂, 2 ♀ syntypes. 1 ♂, Ternei, Ussuri. 7.vii.24./Sichotin Alin Geb., westl. Ternei, Bucha. Juli. 700 m. Ussuri, Ost. Asien./Co-Type e Collection Bang-Haas. 1 ♂, Ternei, Ussuri. 7.vii.24. 1 ♀, Sichotin Alin Geb., westl. Ternei, Bucha. Juli. 700 m. Ussuri, Ost. Asien./Co-Type e Collection Bang-Haas. 1 ♀, Sichotin Alin Geb., westl. Ternei, Bucha. Juli. 700 m. Ussuri, Ost. Asien.

Described from Küstenprovinz: Sichotin Alin mont., Ternei und Tjutiho, Ende Juni bis Juli.

***otos*** Fruhstorfer, 1903 : 46 (as ab. or subsp. of *Parnassius hardtwicki* [lapsus for *hardwickei*]). Holotype ♂. Kaschmir. 14–16,000′. Fruhstorfer.

Not included by Eisner, 1966*a*.

***otto*** Bryk & Eisner, 1932*e* : 66 (as subsp. of *Kailasius charltonius*). 1 ♂, 5 ♀ syntypes. Gya-Ladak, Taglang Pass, Himalaya mont. 5000 m. 15–30. Juli.

***ottonius*** Fruhstorfer, 1909*a* : 161 (as subsp. of *Parnassius apollo*). 1 ♂, 1 ♀ syntypes. Destr. Kustenland, Fuzine. 7. 1906. legit. M. Hilf. Coll. O. Leonard./Fruhstorfer Coll.

Currently placed as a synonym of *Parnassius apollo rhea* Poda.

***parnassia*** Bryk, 1932*c* : 46 (as subsp. of *Parnassius mnemosyne*). 2 ♂, 1 ♀ syntypes. 1 ♂, Parnassus, Kruper. 1890. 1 ♂, Parnass. 1 ♀, Graec., Parnass.

***parthenos*** Bryk, 1932*d* : 68 (as subsp. of *Parnassius orleans*). 3 ♂, 1 ♀ syntypes. Kunkala-Shan, Pr. Szechwan, China.

***parvimacula*** Rothschild, 1909 : 2 (as subsp. of *Parnassius mnemosyne*). 29 ♂, 8 ♀ syntypes. 25 ♂, 8 ♀, Doubes, nr Digne. 25. June 1908. (K. Jordan). 4 ♂, Mt. St. Michel Cousson, Digne, 1000–1500 m. 1. July 1908. (K. Jordan.)

Currently placed as a synonym of *Parnassius mnemosyne dinianus* Fruhstorfer.

***peilingschani*** Bang-Haas, 1932 : 200 (as subsp. of *Parnassius nomion*). 1 ♂ syntype. Kansu mer., Peiling shan, Taupingfluss. 3200 m. Juni./Co-Type e Collection Bang-Haas.

***perfusa*** Verity, 1911 : 312, pl. LXII, fig. 10 (as ab. of *Parnassius apollo*). 1 ♂ syntype. Tyrol.

Currently placed as a form of *Parnassius apollo* L.

***pernigrus*** Fruhstorfer, 1918 : 2 (as subsp. of *Parnassius epaphus*). 1 ♂ syntype. Phasi Thong, Tibet. Hohe 16,500 ft./Fruhstorfer Coll.

Currently placed as a synonym of *Parnassius epaphus phariensis* Avinov.

***pfeifferi*** Bryk & Eisner, 1931*a* : 1, figs 1–2 (as subsp. of *Parnassius mnemosyne*). 5 ♂, 2 ♀ syntypes. 4 ♂, 1 ♀, Anatolien, Egerdir. 1000 m. 15.v.26. E. Pfeiffer leg. 1 ♂, Kyseli-Dagh, 1500. 24.v.29. 1 ♀, Kyseli-Dagh. 1500. 24.v.29.

***phonolithi*** Bryk, 1915*a* : 141 (as var. of *Parnassius apollo*). 1 ♂, 1 ♀ paralectotypes. Hohentweil bei Singen. 1912./Received in exchange from C. Eisner.

Currently placed as a subspecies of *Parnassius apollo* L.

Lectotype designated by Eisner, 1966*a* : 40 (see Introduction).

***phrynius*** Fruhstorfer, 1921 : 30, fig. 3 (as subsp. of *Parnassius apollo*). 1 ♂, 1 ♀ syntypes. 1 ♂, Sölden, Oetztal. 21. Juli 1911. H. Belling./Fruhstorfer Coll. 1 ♀, Sölden, Oetz. 19. Juli 1911. H. Belling./Fruhstorfer Coll.

***pictor*** Bryk & Eisner, 1932*a* : 104 (as subsp. of *Parnassius epaphus*). 1 ♂ paralectotype. Kunkalaschan, Szetschwan./Co-Type e Collection Bang-Haas.

Described from Kunkala-schan, etwa 250 km. n. w. Tatsienlou.

Lectotype designated by Eisner, 1966*a* : 31 (see Introduction).

***piedemontanus*** Fruhstorfer, 1909 : 158 (as race of *Parnassius apollo*). 2 ♂, 2 ♀ syntypes. 1 ♂, 1 ♀, Cognetal, Piemont, Osthelder. 26.vii.1908./Fruhstorfer Coll. 1 ♂, Cognetal, Piemont, Osthelder. 27.vii.1908./Fruhstorfer Coll. 1 ♀, Aosta, Fruhstorfer.

Currently placed as a subspecies of *Parnassius apollo* L.

Described from Piemont, Quellgebiet der Dora-Baltea, but certainly part of the original series.

(Emend. *pedemontanus* Fruhstorfer, Turati, 1911 : 4.)

***planeixi*** Eisner, 1964 : 26, pl. 1, figs 3–4 (as form of *Parnassius apollo arvernensis*). 2 ♂ paratypes. Puy de Cliergue. 1667 m. Massif du Sancy, Mts. Dore. 30.8.1963. L. Philippe.

***posterior*** Peschke, 1921 : 35 (as *Parnassius apollo* form *sztrecsnoensis posterior*). 1 ♂ syntype Tatra, Rossudec, Coll. Peschke, Teschen.

Currently placed as a form of *Parnassius apollo sztrecsnoensis* Pax.

***posthumus*** Fruhstorfer, 1921*l* : 13 (as subsp. of *Parnassius apollo*). 2 ♂ syntypes. Burk, Saalethal./Fruhstorfer Coll.

***princeps*** Honrath, 1887 : 351 (as var. of *Parnassius charltonius*). 1 ♂ syntype. Transalai m./Ex speciminibus typicis.

Currently placed as a subspecies of *Kailasius charltonius* Gray.

***pseudoernae*** Bryk, 1931*a* : 173 (as ab. of *Parnassius delius*). Holotype ♀. Pontresina.

Not included by Eisner, 1966*a*.

***puella*** Bryk, 1934 : 28 [nomen nudum]; 1935*a* : 339 (as subsp. of *Parnassius epaphus*). 1 ♂, 1 ♀ syntypes. 9, 30. Shyok Valley, N. W. Himalaya. 28.vii.1929. F. Ludlow. 1 ♂, 15,000 ft. 1 ♀, 16,500 ft.

***puer*** Bryk & Eisner, 1932*a* : 24, fig. 6 (as subsp. of *Parnassius epaphus*). 2 ♂, 1 ♀ paralectotypes. Rohtang Pass, Kangra, India sept., 4053 m. Juli.

Lectotype designated by Eisner, 1966*a* : 32 (see Introduction).

***punjabensis*** Bang-Haas, 1927 : 23, pl. 4, figs 3–4 (as subsp. of *Parnassius acco*). 6 ♂, 6 ♀ syntypes. 1 ♂, Tum Tum Thang am Spiti-Fluss, N. W. Himalaya, Prov. Punjab. Juli. 5000 m./Co-Type e Collection Bang-Haas. 5 ♂, 6 ♀, Tum Tum Thang am Spiti Fluss, N. W. Himalaya. Juli. 5000 m./Co-Type e Collection Bang-Haas.

Currently placed as a subspecies of *Tadumia acco* Gray.

***pura*** Bang-Haas, 1938*a* : 23 (as form of *Parnassius actius frischi*). 1 ♂ paralectotype. Kansu sept. occ., Richthofen mont. sept., Nashi Pass. 3000 m. Juli./Co-Type, O. Bang-Haas

Lectotype designated by Eisner, 1966*a* : 26 (see Introduction).

**purissima** Bang-Haas, 1938*a* : 23 (as form of *Parnassius orleans schneideri*). 1 ♂ syntype. Kansu sept. occ., Kan-tschou, Richthofen mont. sept., Nashi Pass. 3000 m. Juli./Co-Type, O. Bang-Haas.

**regina** Bryk & Eisner, 1932 : 7 (as subsp. of *Parnassius imperator*). 2 ♂, 1 ♀ paralectotypes. Kansu mer., Min-schan, Tauhe. 2500 m. Juli./Co-Type e Collection Bang-Haas.

Currently placed as a subspecies of *Eukoramius imperator* Oberthür.

Lectotype designated by Eisner, 1966*a* : 57 (see Introduction).

**regulus** Bryk & Eisner, 1932 : 6 (as subsp. of *Parnassius imperator*). 6 ♂, 1 ♀ paralectotypes. 1 ♂, Honanpa, Siang-shin-ho Oberlauf, Ost-Nanschangebirge. 20.8.–10.9. 3500 m. 5 ♂, 1 ♀, Kansu sept., westl. Liangtschou, Shekou, Richthofen mont. 3000 m. August/Co-Type e Collection Bang-Haas.

Currently placed as a subspecies of *Eukoramius imperator* Oberthür.

Described from Shekou, westl. Liangtsou (Kansu), Honanpa, Ost-Nanshan.

Lectotype designated by Eisner, 1966*a* : 56 (see Introduction).

**reinigi** Bryk, 1932*b* : 31, fig. 1 (as subsp. of *Tadumia simo*). 1 ♂ syntype. Lapgaz Valley, Taghumbash, Pamir. 16,500 ft. 14.7.13./Capt. Hingston.

**republicanus** Peebles & Bryk, 1931 : 4 (as subsp. of *Parnassius mnemosyne*). 2 ♂, 2 ♀ syntypes. Hispania, Maladetta, Val de l'Esera./Ex. Coll. H. M. Peebles.

**revisus** Bryk, 1932*c* : 48 (as subsp. of *Parnassius stubbendorfi*). 1 ♂, 1 ♀ syntypes. Barracouta. 28.7.99. T. B. Fletcher.

**rhaeticus** Fruhstorfer, 1906 : 139 (as subsp. of *Parnassius apollo*). 16 ♂, 10 ♀ syntypes. Engadin, Fruhstorfer.

**rhodius** Honrath, 1882 : 178, pl. II, fig. 6 (as var. of *Parnassius actius*). 1 ♂ syntype. Ladak./Specimen typicum.

Not included by Eisner, 1966*a*.

**richthofeni** Bang-Haas, 1927 : 16, pl. 2, fig. 7 (as subsp. of *Parnassius nomion*). 7 ♂, 7 ♀ paratypes. Richthofen Gbg., westl. Liang-tschou, Kansu sept., China. Juli. 2500 m. Co-Type e Collection Bang-Haas.

Described from Kansu sept.: südlich der Stadt Luang-tschan, Richthofen mont. Juli. 2500 m.

**rileyanus** Bryk, 1932*a* : 20 (as subsp. of *Lingamius cephalus*). Holotype ♀. Tibet, Phuse La. 16,000′. 19.iv.1924. Maj. R. W. Hingston.

Currently placed as a subspecies of *Koramius cephalus* Grum-Grshimailo.

**rileyi** Tytler, 1926 : 251, pl. IV, figs 6–7 (as subsp. of *Parnassius delphius*). 1 ♂, 1 ♀ syntypes. Rupal, Val. Astor, Kashmir. 12,500 ft. 6.vii.1920. Gen. H. C. Tytler.

Currently placed as a subspecies of *Koramius delphius* Eversmann.

**rogervarleti** Eisner & Epstein, 1968 : 16 (as subsp. of *Parnassius mnemosyne*). 1 ♂, 1 ♀ paratypes. Helvetia, Ct. Ticino, Val Lavizzara, 900 m. H. & M. Epstein. 1 ♂, 10.vi.1967. 1 ♀, 14.vi.1967.

**romani** Bryk, 1921 : 18, fig. 3 (as form of *Parnassius mnemosyne*). 1 ♂, 1 ♀ paralectotypes. 1 ♂, Björka, Backa. 17.vi.17./ex. Coll. Bryk. 1 ♀, Singo./ex. Coll. Bryk.

Currently placed as a subspecies of *Parnassius mnemosyne* L.

Lectotype designated by Eisner, 1966*a* : 8 (see Introduction).

**roseopicta** Bryk, 1932*a* : 21 (as form of *Lingamius cephalus*). Holotype ♀. Amdo.

Currently placed as a form of *Koramius cephalus* Grum-Grshimailo.

**rotgeri** Bang-Haas, 1938*a* : 20, pl. 1, figs 6 & 9 (as subsp. of *Parnassius phoebus*). 1 ♂, 1 ♀ syntypes. Colorado, Mt. Evans. 4.viii.1937. 12,000 ft./Co-Type, O. Bang-Haas.

**rothschildianus** Bryk, 1931 : 4 (as sp. of *Parnassius*). 2 ♂, 2 ♀ syntypes. Hadja tungoo, 13,000′; to Hadja La, 15,300′; to Patya, 13,200′. 2. June./Szechwan, Kelly-Roosevelt expedition, 1929.

Currently placed as a subspecies of *Tadumia acco* Gray.

**rubidus** Fruhstorfer, 1906 : 137 (as subsp. of *Parnassius apollo*). 17♂, 20 ♀ syntypes. Klausen. 1904. Fruhstorfer.

Described from Eisacktal, but certainly part of the original series.

***sarafschana*** Bryk & Eisner, 1932*f* : 74 (as subsp. of *Parnassius mnemosyne*). 1 ♂, 1 ♀ paralectotypes. Samarkand. vi. 1906.
Lectotype designated by Eisner, 1966*a* : 14 (see Introduction).

***schneideri*** Bang-Haas, 1938*a* : 22, pl. 2, figs 1–2 (as subsp. of *Parnassius orleans*). 1 ♂, 1 ♀ syntypes. Kansu sept. occ., Kan-tschou, Richthofen mont. sept., Nashi Pass. 3000 m. Juli./Co-Type, O. Bang-Haas.
Described from nördl. Richthofen-Geb., 50 km. westlich der Stadt Kantschou, Nashi-Pass. 3000 m.

***semi-novarae*** Rothschild, 1918 : 235 (as ab. of *Parnassius pyrenaicus*). Holotype ♀. Cauterets (Mosquès).
Not included by Eisner, 1966*a*.

***sengei*** Bang-Haas, 1938 : 58 (as subsp. of *Koramius cephalus*). 1 ♂, 1 ♀ syntypes. China sept. occ., Pullow Mont., Min-schan occ. 3500 m. Juli./Co-Type e Collection Bang-Haas.

***septentrionalis*** Verity, 1911 : 319, pl. LXIV, figs 17–18 (as race of *Parnassius eversmanni*). 4 ♂, 1 ♀ syntypes. 1 ♂, Witim, Sib. sept./Elwes Coll. 1 ♂, Witim./Elwes Coll. 1 ♂, Wilui./Godeibt. 19.6.88./Elwes Coll. 1 ♂, Witim./Godeibt. 15.6.88./Elwes Coll. 1 ♀, Vilui./Coll. Gr. Gr./Elwes Coll.
Currently placed as a subspecies of *Parnassius eversmanni* Ménétriés.
Described from Vilui and Vitim.

***serenissimus*** Bryk, 1932*c* : 49 (as subsp. of *Kailasius charltonius*). 3 ♂, 3 ♀ syntypes. Kashmir, Pir Punjab. 15,000 ft. vii–viii. A. R. Fowler.

***serenus*** Fruhstofer, 1921*j* : 17 (as subsp. of *Parnassius delius*). 2 ♂, 1 ♀ syntypes. 1 ♂, Courmajeur. 1907. H. Fruhstorfer. 1 ♂, 1 ♀, Alpes du Piemont, Coll. Ferrier./Coll. Fruhstorfer.
Currently placed as a subspecies of *Parnassius phoebus* F.

***shandura*** Tytler, 1926 : 250, pl. IV, figs 3–4 (as subsp. of *Parnassius jacquemontii*). 2 ♂ syntypes. 1 ♂, Chitral, Shandur Pass. 11–14,000 ft. 10.8.03. A. R. C. Saunders. 1 ♂, Chitral, Shandur Lake. vii. 1901. El. 11,000 ft. Coll. G. A. Leslie & W. H. Evans.
Described from Shandur Pass.

***shekouensis*** Bang-Haas, 1934 : 7 (as subsp. of *Parnassius nomion*). 1 ♂, 1 ♀ syntypes. Kansu sept., westl. Liangtschou, Shekou, Richthofen mont. 3000 m. August./Co-Type e Collection Bang-Haas.

***shepardi*** Eisner, 1966 : 145, pl. I, figs 1–2 (as subsp. of *Parnassius clodius*). 1 ♂ paratype. Spaulding. v.17.54./Miyako, Iwate. 300 m. 27.5.–2.6.19. leg. M. Nozaki.
Described from Spaulding, Idaho.

***shigarensis*** Bang-Haas, 1935*c* : 111 (as subsp. of *Parnassius delphius*). 7 ♂, 1 ♀ syntypes. Baltistan, Shigar, Baltora mont. 5000 m. Juli./Co-Type e Collection Bang-Haas.
Described from 6 ♂, 1 ♀ only. It is not possible to state which of the specimens constitute the syntypic series.

***sicinus*** Fruhstorfer, 1921*l* : 14 (as subsp. of *Parnassius apollo*). 2 ♂, 1 ♀ syntypes. 2 ♂, Teschen, Fruhstorfer. 1 ♀, N. Mähren, Fruhstorfer.
Described from Umgebung von Teschen, Nordmähren.

***sikkimensis*** Elwes, 1882 : 399, pl. XXV, figs 4–5 (as var. of *Parnassius epaphus*). 3 ♂, 2 ♀ syntypes. 2 ♂, 1 ♀, Chumbi, Sikkim, Tibet. 10,000–16,000 ft./Elwes Coll. 1 ♂, 1 ♀, East of Donkia Pass. 18,000′. Sept. 1870. H. J. Elwes.
Currently placed as a subspecies of *Parnassius epaphus* Oberthür.

***silesiacus*** Fruhstorfer, 1908*c* : 18 (as subsp. of *Parnassius mnemosyne*). 2 ♂, 2 ♀ syntypes. Schlesien, Fruhstorfer.

***simo*** Gray 1853 : 76 (as sp. of *Parnassius*). 1 ♂, 2 ♀ syntypes. 1 ♂, 1 ♀ Thibet, Maj. Charlton. 1 ♀, Chinese Tartary. (Pl. 1, fig. 1.)
Currently placed as a species of *Tadumia* Moore.
Described from Chinese Tartary, 16,000 ft, but these specimens are certainly part of the original series.

***sinensis*** Bang-Haas, 1927 : 16, pl. 2, figs 5–6 (as subsp. of *Parnassius nomion*). 6 ♂, 3 ♀ syntypes. Tsing-schi-ling, Nan-schan mont., Sining, Kansu. 2500 m. Juli./Co-Type e Collection Bang-Haas.

Described from Kansu: nordwestlich der Stadt Hsining (=Sining) Tsingschilin, östl. Ausläufer des Nanschan mont., Juli 2500 m.

***sinicus*** Bryk, 1932*c* : 47 (as subsp. of *Parnassius stubbendorfi*). 2 ♂, 1 ♀ syntypes. 1 ♂, Chang-yong. 6000 ft. Native Collector. 1889. 1 ♂, Ichang./Jankowski. 1 ♀, Pu-tsu-fong. 9820 ft. Native Coll. June & July 1890.

Currently placed as a subspecies of *Parnassius glacialis* Butler.

***smintheus*** Doubleday, 1847 : 27, pl. 4, fig. 4 (as sp. of *Parnassius* ). 2 ♂ syntypes. Rocky Mts., Pres. by Earl of Derby.

Currently placed as a subspecies of *Parnassius phoebus* F.

***solonensis*** Bang-Haas, 1927 : 11, pl. 1, figs 11–13 (as subsp. of *Parnassius bremeri*). 2 ♂, 3 ♀ paratypes. 1 ♂, 1 ♀, Mandschur sept. occ., Buchalu, Chingan mont. sept. 1100 m. Juli./Co-Type e collection Bang-Haas. 1 ♂, 2 ♀, Chingan mont. sept., Buchalu, Mandschur occ. Juli. 1100 m./Co-Type e Collection Bang-Haas.

***sotirion*** Fruhstorfer, 1923 : 56 (as subsp. of *Parnassius apollo*). 19 ♂, 3 ♀ syntypes. 14 ♂, Rigi, Fruhstorfer. 2 ♂, Aug. 1915, U'walden, Helv. 1300 m./Fruhstorfer Coll. 2 ♂, 2 ♀, Pilatus, Fruhstorfer. 1 ♂, 1 ♀, Goldau. vii. 1916. Dr E. Fischer, Zurich./Fruhstorfer Coll.

***spitiensis*** Bang-Haas, 1927 : 33, pl. 4, figs 17–18 (as subsp. of *Parnassius stoliczkanus*). 2 ♀ syntypes. Tum Tum Thang am Spiti-Fluss, N. W. Himalaya. Juli. 5000 m. Co-Type e Collection Bang-Haas.

Currently placed as a subspecies of *Koramius delphius* Eversmann.

Described from Spiti: Tum Tum Thang mont., nordwestl. von Pu, nördl. des Sutley Flusses. Juli. 5000 m.

***staudingeri*** Bang-Haas, *in* Staudinger & Bang-Haas, 1882 : 163, pl. II, figs 7, 8 & 8a (as sp. of *Parnassius*). 2 ♂, 2 ♀ syntypes. Ex speciminibus typicis.

Currently placed as a subspecies of *Koramius delphius* Eversmann.

***stenosemus*** Honrath, 1890 : 127 (as var. of *Parnassius delphius*). 1 ♂, 1 ♀ syntypes. 1 ♂, Specimen typicum. 1 ♀, Ladak./Specimen typicum.

Currently placed as a subspecies of *Koramius delphius* Eversmann.

***stoliczkanus*** C. & R. Felder, 1864 : 138, pl. LXIX, figs 2–3 (as sp. of *Parnassius*). 1 ♂ syntype. Dr Stoliczka, Ladak, Thibet. 12–15,000'./Felder Coll. (Pl. 1, Fig. 7.)

Currently placed as a subspecies *Koramius delphius* Eversmann.

***styriacus*** Fruhstorfer, 1907 : 199 (as subsp. of *Parnassius phoebus*). 2 ♂, 1 ♀ syntypes. Hoffmann. 15.8.1907. Reichenstein. 1900 m./Fruhstorfer Coll.

Described from Steyermark, but certainly part of the original series.

***styx*** Staudinger, 1886 : 195 (as ab. of *Parnassius delphius* var. *infernalis*). 1 ♂, 1 ♀ syntypes. 1 ♂, Thian or./Origin./ Elwes Coll. 1 ♀, Origin./Elwes Coll.

Currently placed as a form of *Koramius delphius* Eversmann.

***submarginata*** Bang-Haas, 1938*a* : 23 (as form of *Parnassius orleans schneideri*). 1 ♂, 1 ♀ syntypes. Kansu sept. occ., Kan-tschou, Richthofen mont. sept., Nashi Pass. 3000 m. Juli./Co-Type, O. Bang-Haas.

***subochracea*** Bryk, 1912 : 87 (as ab. of *Parnassius mnemosyne*). 1 ♀ syntype. Erstfeld. 20.iv.10. Fruhstorfer.

Not included by Eisner, 1966*a*.

***substitutus*** Rothschild, 1909 : 10 (as subsp. of *Parnassius apollo*). 138 ♂, 49 ♀ syntypes. 87 ♂, 15 ♀, La Grave, Hautes Alpes. 1500–1800 m. July, 1908. (W. R. & K. J.). 1 ♂, 1 ♀, Le Lautaret, Hautes Alpes. 2000–2300 m. July, 1908. (W. R. & K. J.). 50 ♂, 33 ♀, Pralognan, Savoie. 1400–1700 m. 12–27. August 1908. (W. R. & K. J.).

According to the original description there were only 44 ♂ from Pralognan in the original type-series. It is not possible to state which of the 50 ♂ from Pralognan in the BMNH constitute that part of the syntypic series.

***subtilis*** Bang-Haas, 1927 : 21, pl. 3, fig. 6 (as subsp. of *Parnassius epaphus*). 6 ♂, 3 ♀ paratypes. Karakoram Mont., Schahidulah. 4000 m. Chines Tatarei. Ende Juni./Co-Type e Collection Bang-Haas.

Described from Nordabhang des Karakoram, Chinesische Tatarei, Schahidulah, Anfang Juli, 4500 m.

***superbus*** Austaut, 1889 : 206 (as sp. of *Parnassius*). 4 ♂, 1 ♀ syntypes. 1 ♂, Turkestan, Heyne./Coll. Austaut. 2 ♂, Kudara./Elwes Coll. 1 ♂, Kudara./Kudara, Pamir. South of Pedshenks Glacier. 10–12,000 ft. 6. 87. Coll. Gr. Gr./Elwes Coll. 1 ♀, Kudara. 16.vi.86./ Elwes Coll.

Currently placed as a subspecies of *Parnassius tianschanicus* Oberthür.

Austaut (1889), describing *superbus*, attributed the authorship to Grum-Grshimailo; however the latter's description was not published until 1890. I have included type-specimens of both authors in the syntypic series.

***symphorus*** Fruhstorfer, 1910 : 155 (as subsp. of *Parnassius mnemosyne*). 1 ♂, 1 ♀ syntypes. Macugnaga. 10. Fruhstorfer.

***syra*** Verity, 1911 : 321, pl. LXV, fig. 5 (as race of *Parnassius mnemosyne* var *nubilosus*). 1 ♂ syntype. Hermon. 6,000 ft. Nicholl./Elwes Coll.

Currently placed as a form of *Parnassius mnemosyne akbesiana* Sheljuzhko.

***tadschikistana*** Bryk, 1932*c* : 46 (as subsp. of *Parnassius mnemosyne*). Holotype ♂. Sary-poul, Prov. Kuliab, Afghanistan.

Described from Tadschikistan : Prov. Kuliab, Sary-poul.

***tagalangi*** Bang-Haas, 1927 : 23, pl. 4, figs 1–2 (as subsp. of *Parnassius acco*). 2 ♀ syntypes. Gya-Ladak, Taglang Pass, Himalaya mont. 5000 m. 15–30. Juli./Co-Type e Collection Bang-Haas.

Currently placed as a subspecies of *Tadumia acco* Gray.

Described from Ladak mer: Tagalang Pass, südl. des Ortes Gya, Mitte bis Ende Juli, 5000 m.

***tajanus*** Bryk, 1932*c* : 48 (as subsp. of *Parnassius stubbendorfi*). 4 ♂, 1 ♀ syntypes. China, Shantung, Taian, Tsaishan Mt. End May 1926. E. Hindle.

Currently placed as a subspecies of *Parnassius glacialis* Butler.

***talboti*** Bryk, 1932*b* : 33 (as subsp. of *Parnassius mnemosyne*). 1 ♂, 2 ♀ syntypes. Zara./ Ex. Coll. H. M. Peebles./Ex. Coll. H. J. Elwes.

***taschischani*** Bang-Haas, 1933 : 262 (as subsp. of *Parnassius nomion*). 3 ♂, 2 ♀ syntypes. Kansu mer. or., Ta-schi-schan. August. 3000 m./Co-Type e Collection Bang-Haas.

***taupingi*** Bang-Haas, 1932 : 200 (as subsp. of *Parnassius stubbendorfi*). 3 ♂ syntypes. Kansu mer., Peiling schan, Taupingfluss. 3200 m. Juli./Co-Type e Collection Bang-Haas.

Currently placed as a subspecies of *Parnassius stubbendorfi* Ménétriés or *Parnassius glacialis* Butler.

Described from Kansu mer. or., Peilingschan, Taupingfluss. Mai-Juli, 2000–3000 m.

***tauricus*** Bryk & Eisner, 1930*b* : 2, pl. I, figs 1–4 (as subsp. of *Parnassius apollo*). 10 ♂, 4 ♀ paralectotypes. 7 ♂, 1 ♀, Anamas-Karst, Pisid. Taurus, L. Weirather. 3 ♂, 3 ♀ Ovadschyk-Gruppe, Pamphyl Taurus, L. Weirather.

Lectotype designated by Eisner, 1966*a* : 39 (see Introduction).

***temora*** Fruhstorfer, 1922*a* : 18 (as subsp. of *Parnassius mnemosyne*). 2 ♂ syntypes. 1 ♂, Braunwald. vii. 1908./Fruhstorfer Coll. 1 ♂, Talalpsee, 8.6.19./Fruhstorfer Coll.

***tenebrosus*** Fruhstorfer, 1923 : 56 (as subsp. of *Parnassius apollo*). 2 ♂ syntypes. Glärnisch, August, H. Fruhstorfer.

***tenuis*** Bryk & Eisner, 1932*a* : 25 (as subsp. of *Parnassius stoliczkanus*). 3 ♂ paralectotypes. Gya-Ladak, Taglang Pass, Himalaya mont. 5000 m. 15–30. Juli./Co-Type e Collection Bang-Haas.

Currently placed as a subspecies of *Koramius delphius* Eversmann.

Lectotype designated by Eisner, 1966*a* : 52 (see Introduction).

***tergestus*** Fruhstorfer 1910*a* : 192 (as subsp. of *Parnassius mnemosyne*). 3 ♂, 5 ♀ syntypes. Erstfeld. 20.vi.10. Fruhstorfer.

Described from Kanton Uri, Umgebung von Erstfeld.

***tessinorum*** Fruhstorfer, 1921*i* : 14 (as subsp. of *Parnassius delius*). 2 ♂ syntypes. 1 ♂, Tessin. 1918. Passo Cagnone. 2200 m. Fruhstorfer. 1 ♂, Tessin. 1918. Cima Rianca, Fruhstorfer.

Currently placed as a subspecies of *Parnassius phoebus* F.

Described from Tessiner Alpen der Verzasca-Gruppe. Cima di Cagnome aus 2000–2400 m; 1.viii.1918. Cima Bianca ca. 1800–2000 m; 30.vii.1918. Oberes Val Lodrino, zwischen der Alpe Piavacra und Stuvello, ca. 1800 m (15.viii.1918).

***thaleia*** Fruhstorfer, 1916 : 27 (as subsp. of *Parnassius mnemosyne*). 1 ♂, 2 ♀ syntypes. Kufstein, Tirol./Fruhstorfer Coll.

***thebaida*** Fruhstorfer, 1922*c* : 31 (as subsp. of *Parnassius mnemosyne*). 4 ♂, 1 ♀ syntypes. Val Maggina. 12–14. vii. 8–1200 m./Fruhstorfer Coll.

Described from Tessin, Nordfluss des Monte Camoghé, Val Maggina (1000–1200 m.) Anfang bis Mitte Juli 1917.

***thessalicus*** Bang-Haas, 1934*a* : 110 (as subsp. of *Parnassius apollo*). 2 ♂, 1 ♀ syntypes. Graecia, Thessalia, Olymp. 2200 m. Aug./Co-Type e Collection Bang-Haas.

Currently placed as a synonym of *Parnassius apollo olympiacus* Kolar.

***thiemo*** Fruhstorfer, 1909 : 151, 1921*h* : 130 (status not given). 2 ♀ syntypes. Neu-Ulm, Fruhstorfer.

Currently placed as a subspecies of *Parnassius apollo* L.

***tibetanus*** Ruhl, 1892 : 99 (as sp. of *Parnassius*). 8 ♂, 8 ♀ syntypes. Hou-Kow, Thibet. 10,000 ft. Native Coll. July–Aug. 1890.

Currently placed as a subspecies of *Parnassius jacquemontii* Boisduval.

Described from Ta-tsien-lo, but these specimens are certainly part of the original series.

***tibuella*** Bang-Haas, 1933 : 262 (as subsp. of *Parnassius hardwicki*). 1 ♂ syntype. Thibet Occid., Lomad Guge, westl. Gartok, Kyukrang Pass. 5000 m. August./Co-Type e Collection Bang-Haas.

Currently placed as a subspecies of *Lingamius hardwickei* Gray.

Described from Thibet occ., Tibu, westl. Gartok. Juli. 5000 m.

***timanicus*** Eisner & Sedych, 1964 : 137, pl. I, figs 1–2 (as subsp. of *Parnassius mnemosyne*). 4 ♂ paratypes. Timan-Kette bei Uchta, 1. Sedych./Museum Leiden, verzameling C. Eisner. 2 ♂, 15.6.1963. 2 ♂, 25.6.1963.

***titan*** Fruhstorfer, 1904 : 308 (as subsp. of *Parnassius nomion*). 1 ♂ syntype. Sutschan, Fruhstorfer.

***totireducta*** Bang-Haas, 1938*a* : 23 (as form of *Parnassius actius frischi*). 1 ♂, 1 ♀ syntypes. Kansu sept. occ., Kan-tschou, Richthofen mont. sept., Nashi Pass. 3000 m. Juli.

***transiens*** Austaut, 1889 : 81, pl. 18, fig. 3 (as sp. of *Parnassius*). Holotype ♂. Tura. Coll. Austaut.

Currently placed as a subspecies of *Koramius delphius* Eversmann.

***transitoria*** Eisner, 1958 : 26 (as subsp. of *Parnassius apollo*). 1 ♂ syntype. O. Zickermann, D'dorf Oberdrauburg-Kärnten. 6000 m. 25.v.1945./Museum Leiden, ex. collectie C. Eisner.

***tschiliensis*** Bang-Haas, 1927 : 15, pl. 2, figs 1–2 (as subsp. of *Parnassius nomion*). 1 ♂, 1 ♀ syntypes. Chi feng hsien, Prov. Tschili, China sept./Co-Type e Collection Bang-Haas.

Described from Prov. Tschili, (Tschiföng-Chifengshien), Lin si hien, Ostseite des Chingan mont.

***tsinglingensis*** Bryk & Eisner, 1932*b* : 26 (as subsp. of *Parnassius nomion*). 3 ♂, 3 ♀ paralectotypes. 1 ♂, 2 ♀, Prov. Kansu or., Tapaischan, Tsinglingschan mont. 2800 m. August./Co-Type e Collection Bang-Haas. 1 ♂, Prov. Shensi, Tapaischan, Tsinglingschan. 2000 m. 24. 6./Co-Type e Collection Bang-Hass. 1 ♂, Prov. Shensi, Tapaischan, Tsinglingschan. 3000 m./Co-Type e Collection Bang-Haas. 1 ♀, Prov. Shensi, Tapaischan, Tsinglingschan. 2800 m. August./Co-Type e Collection Bang-Haas.

Described from Schensi, Tapaischan, Tsinlingschan, 3000 m. VI.; Tsingschui, Liu-pinschan, 2000 m. VII.

Lectotype designated by Eisner, 1966*a* : 35 (see Introduction).

***tubulus*** Fruhstorfer, 1908 : 12 (as subsp. of *Parnassius mnemosyne*). 5 ♂, 2 ♀ syntypes. 5 ♂, Lunz, N. Oestr., Fruhstorfer. 2 ♀, Schoberstein, Fruhstorfer.

***tyrannus*** Bryk, 1932*d* : 67 (as subsp. of *Parnassius orleans*). Holotype ♂. Dochachge mont., Grum. Col. 1890.

Described from Jakar (Dschakar), but certainly the type specimen.

***tyrranus*** Bang-Haas, 1935*a* : 183. See *uxoria* Bang-Haas.

***ucrainica*** Bryk, 1932*b* : 33 (as subsp. of *Parnassius mnemosyne*). 1 ♂, 7 ♀ syntypes. Iljintzy, Lipovetaki ujesd. (gub Kiew). 1 ♂, 2 ♀, 22.v.1913. 1 ♀, 12.v.1913. 1 ♀, 17.v.1913. 1 ♀, 19.v.1913. 1 ♀, 20.v.1913. 1 ♀, 23.v.1913.

***ugrjumovi*** Bryk, 1914*a* : 201, pl. II, figs 1–2 (as subsp. of *Parnassius mnemosyne*). 1 ♂, 1 ♀ paralectotypes. Jelabuga, leg. Ugrjumov./ex. Coll. Bryk.

Lectotype designated by Eisner, 1966*a* : 11 (see Introduction).

***ultrabella*** Fruhstorfer, 1922 : 16 (as subsp. of *Parnassius mnemosyne*). 31 ♂, 6 ♀ syntypes. 31 ♂, 4 ♀, Schaffhausen./Fruhstorfer Coll. 2 ♀, Schaffhaus., Fruhstorfer.

***umbratilis*** Fruhstorfer, 1908*c* : 17 (as form of *Parnassius mnemosyne hartmanni*). 1 ♀ syntype. Königssee, Fruhstorfer.

***unimacula*** Bryk, 1934*a* : 32 (as form of *Parnassius orleans*). Holotype ♀. Hou-Kow, Thibet. 10,000′. Native Coll. July & Aug. 1890.

***uralka*** Bryk, 1921*a* : 115, figs 5–7 (as var. of *Parnassius mnemosyne*). 1 ♂, 2 ♀ syntypes. 1 ♂, Uralka, Orenburg./Coll. Eisner, Berlin. 2 ♀, Uralka, Orenburg, Coll. Sandig./ex. Coll. Bryk.

Currently placed as a subspecies of *Parnassius mnemosyne* L.

***utahensis*** Rothschild, 1918 : 233 (as subsp. of *Parnassius phoebus*). 1 ♂ syntype. Park City, Utah. July. 95. A. J. Snyder.

***uxoria*** Bang-Haas, 1935*b* : 35 (as replacement name for *Parnassius imperator tyrranus* Bang-Haas, 1935*a* : 183 [nomen praeocc.]). 1 ♂, 1 ♀ syntypes. Kuku-nor, Lussa, südlich Sining. 2600 m. Ende Juli./Co-Type e Collection Bang-Haas.

Currently placed as a subspecies of *Eukoramius imperator* Oberthür.

Described from Prov. Tsinghei (= Kukunor), Lussa, 50 km. südlich von Sining. 2600 m. Juli.

***valdieriensis*** Verity, 1911 : 309, pl. LV, figs 15–16 (as race of *Parnassius apollo*). 5 ♂, 5 ♀ syntypes. Valdieri, Piedmont, Maritime Alps. 4,500 ft. 1.8.1909.

Currently placed as a subspecies of *Parnassius apollo* L.

***valesiacus*** Fruhstorfer, 1906 : 140 (as subsp. of *Parnassius apollo*). 37 ♂, 32 ♀ syntypes. 34 ♂, 31 ♀, Zermatt. 1906. Fruhstorfer. 3 ♂, 1 ♀, Simplon. 1905. Fruhstorfer.

***venaissinus*** Fruhstorfer, 1921*g* : 114 (as subsp. of *Parnassius apollo*). 7 ♂, 1 ♀ syntypes. M. Ventoux, Fruhstorfer.

Described from only 5 ♂, 1 ♀. It is not possible to state which of the specimens constitute the syntypic series.

***verityi*** Rothschild, 1918 : 249 (as subsp. of *Parnassius discobolus*). 1 ♂ syntype. Korla.

Not included by Eisner, 1966*a*.

***victorialis*** Fruhstorfer, 1921 : 29 (as subsp. of *Parnassius apollo*). 2 ♂, 2 ♀ syntypes. 1 ♂, 1 ♀, Trient, Fruhstorfer. 1 ♂, 1 ♀, Südtirol, Fruhstorfer.

***vindobonensis*** Bollow, 1929 : 57 (as race of *Parnassius apollo*). 1 ♂, 1 ♀ syntypes. Austr. inf., Weissenbach. 1 ♂, 5.vii.1922. H. Kolar. 1 ♀, 20.vii.1918. Dr H. Kolar.

Currently placed as a subspecies of *Parnassius apollo* L.

***viridicans*** Fruhstorfer, 1909*b* : 111, pl. 50, figs c–d (as subsp. of *Parnassius hardwicki*). 30 ♂, 18 ♀ syntypes. Sikkim, Trockenzeit, H. Fruhstorfer.

Currently placed as a form of *Lingamius hardwickei albicans* Fruhstorfer.

***vogti*** Bang-Haas, 1938 : 58 (as subsp. of *Koramius acdestis*). 1 ♂, 1 ♀ syntypes. China, Pullow Mont., Min-schan. 3500 m. Juli./Co-Type e Collection Bang-Haas.

***voigti*** Bang-Haas, 1927 : 38, pl. 3, fig. 13 (as subsp. of *Parnassius charltonius*). 1 ♀ paratype. Paghman Gbg., Kabul, Afghanistan./Co-Type e Collection Bang-Haas.

Currently placed as a subspecies of *Kailasius charltonius* Gray.

Described from Afghanistan: Pagmann mont., 30 km. nördl. von Kabul am An Suchas. Pass. 3500 m. 24–30. August 1926.

***wagneri*** Bryk, 1925 : 30 (as var .of *Parnassius mnemosyne*). 1 ♂, 1 ♀ paralectotypes. Rumaenia, Hatcarau, Distr. Prahova, Coll. Wagner./Rec'd in exchange from C. Eisner.

Currently placed as a subspecies of *Parnassius mnemosyne* L.

Lectotype designated by Eisner, 1966*a* : 10 (see Introduction).

***weidingeri*** Bryk & Eisner, 1932*d* : 40 (as subsp. of *Parnassius mnemosyne*). 2 ♂, 2 ♀ paralectotypes. 1 ♂, Penza. 15.v.25. 1 ♂, 2 ♀, Pensa.

Lectotype designated by Eisner, 1966*a* : 11 (see Introduction).

***whitei*** Bingham, 1907 : 125, fig. 33 (as race of *Parnassius delphius*). Holotype ♂. Sikkim. 19,3000′. vii. 1902. C. White. Bingham Coll.

Currently placed as a subspecies of *Koramius acdestis* Grum-Grshimailo.

Described from Sikkim, 16,000–19,000 ft.

***xerophilus*** Fruhstorfer, 1923 : 58 (as subsp. of *Parnassius apollo*). 23 ♂, 4 ♀ syntypes. Mesocco. vii. 700 m. Fruhstorfer.

Described from Mesolcina oder Misox 6–8.vii.1916. Bergell oder Val Bregalga 25.vi.1917, but these specimens are certainly part of the original series.

***yglanus*** Fruhstorfer, 1921*f* : 88 (as subsp. of *Parnassius apollo*). 1 ♀ syntype. Rila-Planina. 1400 m./Bulgarien, Al. K. Drenowski./Fruhstorfer Coll.

Currently placed as a synonym of *Parnassius apollo rhodopensis* Markow.

***yukonensis*** Eisner, 1969 : 175 (as subsp. of *Parnassius phoebus*). 2 ♂ paratypes. 18 miles S.W. Haines Junction. 4,000′. Yukon, Alaska. 1 ♂, 9. Juni 1968. 1 ♂, 22. Juni 1968.

***zanskarica*** Bang-Haas, 1935 : 152 (as subsp. of *Parnassius stoliczkanus*). 1 ♂, 1 ♀ syntypes. Kaschmir mir., Nira, Zanskar mont. 4500 m. Juli./Co-Type e Collection Bang-Haas.

Currently placed as a subspecies of *Koramius delphius* Eversmann.

***zarraensis*** Bang-Hass, 1935 : 152 (as subsp. of *Parnassius simo*). 1 ♂, 1 ♀ syntypes. Kashmir mer. or., Zarra, Taglang Pass. 5000 m. Juli./Co-Type e Collection Bang-Haas.

Currently placed as a subspecies of *Tadumia simo* Gray.

***zogilaica*** Tytler, 1926 : 251, pl. IV, fig. 5 (as subsp. of *Parnassius delphius*). Holotype ♀. 24.7.23. 10,500′./Ex. Coll. H. M. Peebles./Tytler Coll.

Currently placed as a subspecies of *Koramius delphius* Eversmann.

Described from near Zogila Pass, N. Kashmir.

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## PLATE I

FIG. 1. *Tadumia simo* Gray, ♂ syntype ('Thibet, Maj. Charlton'), upper- and underside.

FIG. 2. *Kailasius charltonius* Gray, ♀ syntype ('Thibet, Maj. Charlton'), upper- and underside.

FIG. 3. *Parnassius glacialis* Butler, ♂ syntype ('Japan, Hakodadi'), upper- and underside.

FIG. 4. *Parnassius epaphus himalayensis* Elwes, ♂ lectotype ('Lahoul, 12,000 ft., Young, 8.84.'), upper- and underside.

FIG. 5. *Koramius acdestis* Grum-Grshimailo, ♀ syntype ('Sinin Alp'), upper- and underside.

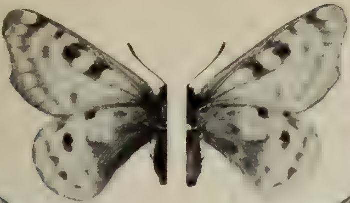
FIG. 6. *Lingamius hardwickei* Gray, ♂ syntype ('Nepal, Hardwicke Bequest'), upper- and underside.

FIG. 7. *Koramius delphius stoliczkanus* C. and R. Felder, ♂ syntype ('Dr Stoliczka, Ladak, Tibet. 12–15,000′), upper- and underside.

FIG. 8. *Koramius cephalus* Grum-Grshimailo, ♂ syntype ('Liangtcha-sien'), upper- and underside.

FIG. 9. *Tadumia acco* Gray, ♀ syntype ('Thibet, Maj. Charlton'), upper- and underside.

FIG. 10. *Parnassius epaphus* Oberthür, ♂ lectotype ('Thibet, Maj. Charlton'), upper- and underside.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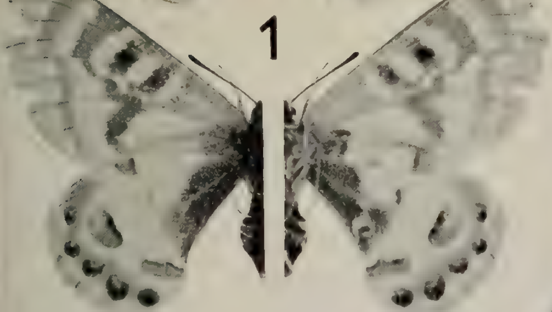
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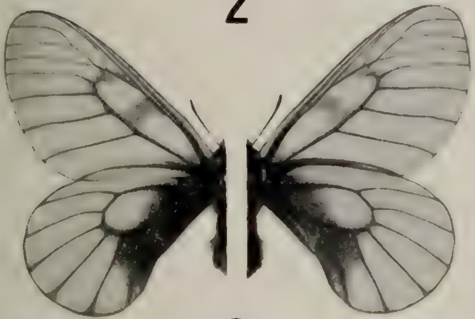
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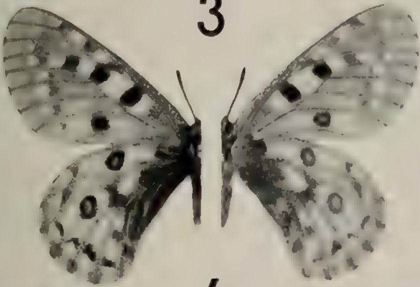
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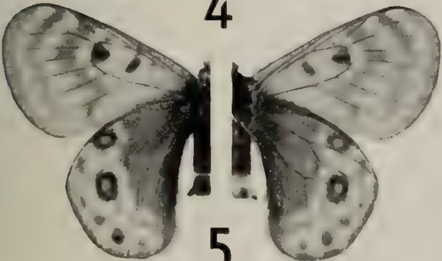
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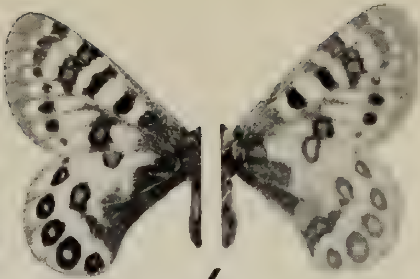
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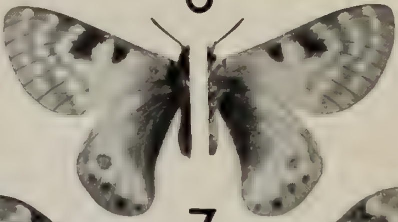
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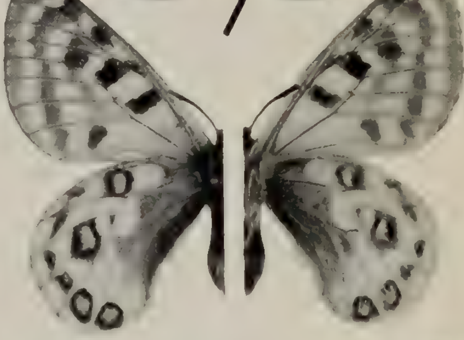
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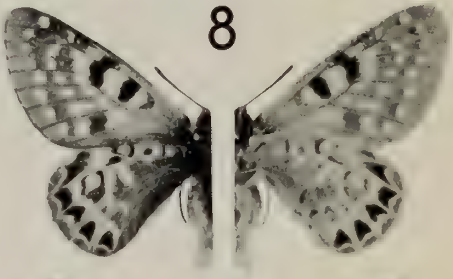
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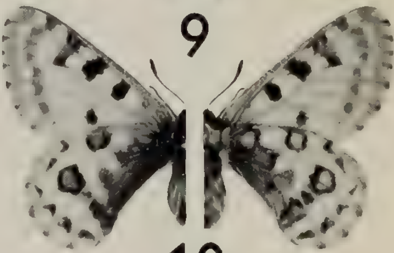
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# A REVISION OF THE GENUS *SILVANUS* LATREILLE (S. L.) (COLEOPTERA : SILVANIDAE)

D. G. H. HALSTEAD

BULLETIN OF
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ENTOMOLOGY Vol. 29 No. 2
LONDON : 1973

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BRITISH MUSEUM
-7 DEC 1973
NATURAL HISTORY

BY

DAVID GORDON HOWARTH HALSTEAD
Pest Infestation Control Laboratory, Slough

*Pp.* 37–112; 179 *Text-figures*

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*By* D. G. H. HALSTEAD

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## SYNOPSIS

Keys to, and descriptions of, seven genera and thirty-seven species are given. Three new genera are described and three are raised from subgeneric rank. Ten new species are described, ten new specific synonymies are made and lectotypes are designated where possible. Erroneous entries in the list of *Silvanus* in Junk's *Coleopterorum Catalogus* are listed and certain species are re-allocated to *Silvanolomus*, *Monanus*, *Silvanoprus* and *Oryzaephilus*.

## I. INTRODUCTION

THIS is the first of a series of studies on the genera of Silvanidae which are associated with stored products. Members of the genus *Silvanus* (s. l.) are fairly regularly intercepted in small numbers on imports to Britain, particularly from the Oriental and Ethiopian regions.

The genus *Silvanus* was erected by Latreille (1804) for *Ips unidentata* Olivier, a species also known at that time as *Dermestes unidentatus* and attributed to Fabricius, who had placed *unidentata* of Olivier in *Dermestes* (Fabricius, 1792*a*). Later Latreille (1807) gave a detailed description of *Silvanus* and Sturm (1826) added *Dermestes bidentatus* Fabricius. Subsequently many species were described in the genus, notably by Reitter and Grouvelle, and *Silvanus* became a repository for an assortment of unrelated species. Finally Grouvelle (1912) published *Notes sur les Silvanini* in which he endeavoured to bring order to the chaos. This important contribution contains descriptions and some keys and is the most recent on the classification of the subfamily Silvaninae. The genera described in the present study belong to this subfamily.

Hetschko (1930) catalogued the Silvanidae in Junk's *Coleopterorum Catalogus*, including 55 species in *Silvanus*, but his list contains a large number of erroneous entries. The following species are included both in *Silvanus*, the genus in which they were originally described, and in their correct genera: *albertesi* Grouvelle and *longicornis* Grouvelle (see *Monanus*, pp. 71–72); *abeillei* Guillebeau and *aridulus* Blackburn (see *Oryzaephilus*, p. 67); *latus* Fairmaire (see *Nausibius*, p. 73); *nubigena* Wollaston (see *Airaphilus*, p. 79); *orientalis* Grouvelle (see *Silvanoprus*, p. 64).

The species *angulicollis* Reitter is included in *Silvanus* but not in its correct genus, *Silvanops*, of which it is the type-species. '*Silvanus crenatulus* Blackburn' and '*Silvanus ornatulus* Blackburn' appear to be entirely cataloguer's errors as these names were not used in the paper referred to by Hetschko and a search through Lea (1912), which includes a list of the Coleoptera described by Blackburn, failed to reveal them. Apart from the above 10 errors there are 11 species in Hetschko which are either *species enquirendae* or must be reallocated; these are as follows:

| Hetschko (1930) | New combination, synonym or comments. |
|---|---|
| *Silvanus armatulus* Blackburn, 1891 : 118 | *Silvanolomus armatulus* (Blackburn) **comb. n.** |
| *Silvanus monticola* Blackburn, 1891 : 118 | *Monanus monticola* (Blackburn) **comb. n.** |
| *Silvanus birmanicus* Grouvelle, 1892 : 863 | *Silvanoprus birmanicus* (Grouvelle) **comb. n.** |
| *Silvanus frater* Grouvelle, 1904 : 184 | *Silvanoprus frater* (Grouvelle) **comb. n.** |
| *Silvanus porrectus* Walker, 1859 : 53 | *Silvanoprus porrectus* (Walker) **comb. n.** |
| *Silvanus fauveli* Reitter, 1890 : 256 | *Oryzaephilus fauveli* (Reitter) **comb. n.** |
| *Silvanus brevicornis* Erichson, 1842 : 218 | Type not found, Blackburn (1903) places this species in *Myrabolia* (Erotylidae). |
| *Silvanus parviceps* Casey, 1916 : 136 | *Cathartus longulus* Blatchley, 1910 : 564. Indiana [one broken type-specimen (Holotype?) in Purdue University, Indiana, compared with *S. parviceps* by Dr A. Provonsha at author's request].<br>*Silvanus parviceps* Casey, 1916 : 136. Holotype, sex indet., New York, (USNM, Washington) [examined]. **Syn. n.** |

| Hetschko (1930) | New combination, synonym or comments. |
|---|---|
| *Silvanus* (*Cathartoides*) *africanus* Kessel, 1921 : 27 | Type lost, description of species and subgenus (sides of pronotum margined) based on unique type does not suggest a member of the genera described in this study. |
| *Silvanus costatus* Steinheil, 1869 : 256 | Type not found. Reitter (1880) suggested that this species was a Tenebrionid. |
| *Silvanus retrahens* Walker, 1858 : 207 | Type lost, description inadequate. |

Only one species, *Silvanus tropicalis* Van Dyke, has been described since Hetschko's catalogue.

In addition to the nominal subgenus, Grouvelle (1912) described four subgenera and Kessel (1921) one, *Cathartoides* (see above). In the present study subgenera have not been used. Three of Grouvelle's subgenera, *Cathartosilvanus* (4 spp.), *Protosilvanus* (5 spp.) and *Parasilvanus* (6 spp.) are raised to generic rank. Three new genera are described, *Pensus* (2 spp.), *Calpus* (1 sp.) and *Silvanoides* (2 spp.). The genus *Silvanus* (sensu stricto of the present revision) contains 17 species, including 5 new species.

## II. GENERIC RELATIONSHIPS

Grouvelle (1912) distinguished subgenera within *Silvanus* using characters provided by the antennae, femoral line, distance between pro- and mesocoxae, body-form and pleurosternal suture (the last-mentioned being of little value). A study of the male genitalia, mouth parts and secondary sexual characters of Grouvelle's *Silvanus* and other genera with similar facies (*Silvanops*, *Silvaninus*, *Silvanoprus*, *Cathartus* and *Ahasverus*) has shown that Grouvelle's subgenera, except *Microsilvanus*, merit generic rank. *Microsilvanus* was erected for three species which are synonymized with *Silvanus recticollis* Reitter in the present study. The general facies of this species is indeed rather distinctive, as it is small and dull with anterior angles of the pronotum not or little produced laterally and has somewhat moniliform antennae. However, the parameres of *S. recticollis* are similar to those of other *Silvanus* and the antennae seem to represent merely an extreme case of the variation found in the genus.

The seven genera described in this revision seem to be fairly closely related, although *Parasilvanus and Protosilvanus* are more closely related to each other than to the other genera. Species of *Parasilvanus* and *Protosilvanus* are far more elongate than species in the other genera and have different antennae, secondary sexual characters, labial and maxillary palps. The close relationship of these two genera is shown by the mouth-parts (Text-figs 129–132) and the small tooth near the apex of the male metatibia of most species (Text-fig. 152). In addition, the males of *Protosilvanus fasciatus* sp. n. and *Protosilvanus carinatus* (Grouvelle) have a tubercle on abdominal sternite 3 as in *Parasilvanus* and the male sternites 8 and 9 are similar in these genera.

The following characters combined, which include those used by Grouvelle (1912) in his key to the subfamily (pp. 384–385), will serve to distinguish the genera *Silvanus*, *Cathartosilvanus*, *Protosilvanus*, *Parasilvanus*, *Pensus*, *Calpus* and *Silvanoides* from the other known genera in the subfamily:

(1) Tarsi simple, i.e. neither lobed nor appearing lobed and segment 3 not incrassate.
(2) Thorax with sides finely denticulate, not margined; anterior angles usually produced antero-laterally.
(3) Antennae terminated by a 3-segmented club (first club-segment not much narrower than second), apical segment not obviously elongate.

Some species of *Silvanoprus*, a genus in which segment 3 of the tarsus is incrassate (appearing lobed), are remarkably similar to *Silvanus*.

## III. HABITATS AND DISTRIBUTION

Most of the Silvanidae are subcorticolous and the genera described here are usually found under the bark of fallen or felled trees. European and N. American species are commonly found beneath the bark of deciduous trees, especially oak (*Quercus* spp.) and sweet chestnut (*Castanea* spp.), less frequently under the bark of pine (*Pinus* spp.). African and oriental species have been found under the bark of *Ficus* etc. and the Australian *Silvanus lateritius* (Broun) beneath that of *Eucalyptus*. Fungal spores have been observed in the gut of specimens dissected for genitalia suggesting that mould, which abounds in the subcorticolous habitat, may form part of their diet.

Twelve species have been found associated with stored products imported to Britain, *Silvanus lewisi* Reitter, *S. productus* sp. n., *S. difficilis* sp. n., *S. proximus* Grouvelle, *S. inarmatus* Wollaston, *S. castaneus* MacLeay, *S. lateritius* (Broun), *S. bidentatus* (F.), *Cathartosilvanus vulgaris* (Grouvelle), *Protosilvanus lateritius* (Reitter), *Parasilvanus ocellatus* (Grouvelle), *P. fairmairei* (Grouvelle) and four of these *S. inarmatus* and *S. proximus* (both African), *S. lewisi* and *S. difficilis* (Oriental) occur fairly frequently although in small numbers. A direct connection between the natural habitat and stored products is suggested by field records for *S. proximus*, which is apparently common on oil-palm fruits (*Elaesis*) and for *S. inarmatus*, which has been found on maize heads on several occasions. *Silvanus inarmatus*, *Parasilvanus ocellatus* and *P. fairmairei* have been found on timber in Britain and Italy and the occurrence of these and other species on stored produce may often be due to cross-infestation from dunnage and timber.

The distribution of the genera is as follows:

*Silvanus* – World, but apparently not represented in S. America.
*Cathartosilvanus* and *Pensus* – Nearctic and Neotropical.
*Protosilvanus*, *Calpus* and *Silvanoides* – Oriental.
*Parasilvanus* – Ethiopian.

Species are extremely widely distributed and their distribution may have been assisted by man through food and timber transportation and silviculture, as indicated above. The distribution of certain species, e.g. *Silvanus proximus* (African) in the West Indies and *Silvanus lateritius* (Australian) in Madeira and South Africa, can be explained on this basis.

## IV. SECONDARY SEXUAL CHARACTERS

Secondary sexual characters are exhibited by the males and are probably used for alignment and gripping during copulation. Modification of the hind legs occurs in all genera, one or more of the following characters being found: trochanter with a spine, femur bearing a ridge, tibia with a row of spines or a tooth at its apex. In some *Parasilvanus* species the sutural stria is depressed towards the apex and in this genus and *Protosilvanus* the abdominal sternites may have a median tubercle. In *Cathartosilvanus vulgaris* the first visible sternite usually has a median longitudinal carina.

In all genera males, especially large individuals, tend to have more elongate thoraces than females.

## V. NOTES ON SPECIFIC CHARACTERS, DESCRIPTIONS AND LABELLING

Specific characters are provided by pronotal form, particularly the anterior angles, puncturation of head and thorax, eye-size and temple-length. However, in certain species the shape of the pronotum is extremely variable, e.g. *Silvanus inarmatus* (Text-figs 51–56) and may lead to confusion. Other characters, apart from those given in the keys, are given in 'Comparative notes' and in difficult cases careful attention should be paid to these. Unfortunately while genitalia are useful at the generic level, they are only occasionally of use in separating very closely related species except in the genus *Parasilvanus*.

In descriptions of species 'length' is measured from apical margin of clypeus to apex of elytra; head-length from clypeal margin to back of vertex and breadth across base of temples; pronotal length from anterior margin to margin of basal foramen and breadth across widest part excluding the anterior angles; elytral length includes the scutellum and breadth is the maximum across the elytra. Ratios were calculated from measurements made on individuals chosen to cover the form and size range.

Figures have been drawn by the author and although the mandibles and labrum are partly visible from above these have been omitted. Illustration of the ♂ median lobe necessitated dissection and compression of this curved part of the genitalia. Puncturation has been drawn from scanning electron micrographs.

Generally locality data have been summarized for previously described species and a geographical arrangement for larger divisions and countries has been attempted. (The ex-Belgian territory in Africa, often referred to as Congo (Kinshasa), is given its current name, Zaire, throughout this paper.) Only reference numbers and a summary of habitat data are given for material collected by M. H. de Saeger in the Garamba National Park (Zaire), since this material is fully documented by de Saeger (1956). Where the label data of primary types have been quoted verbatim, the sign '/' has been used to show the extent of each label. Except where it would obviously be of value to state the location of a particular specimen, a list of museums, etc., is given after the list of localities. A list of the abbreviations used for museums, etc., is given below.

| | |
|---|---|
| AM | The Australian Museum, Sydney. |
| ANIC | Australian National Insect Collection, C.S.I.R.O., Canberra. |
| BMNH | British Museum (Natural History). |
| BPBM | Bernice P. Bishop Museum, Honolulu. |
| CAS | California Academy of Sciences, San Francisco. |
| IFAN | Institut Fondamental d'Afrique Noire, Université de Dakar, Senegal. |
| IRSNB | Institut Royal des Sciences Naturelles de Belgique, Brussels. |
| MCZ | Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts. |
| MD | Museu do Dundo, Companhia de Diamantes de Angola, Dundo, Lunda, Angola. |
| MF | Museum G. Frey, Entomologisches Institut, Tutzing. |
| MNHN | Muséum National d'Histoire Naturelle, Paris. |
| MRAC | Musée Royal de l'Afrique Central, Tervuren. |
| NMV | National Museum of Victoria, Melbourne. |
| PICL | Pest Infestation Control Laboratory, Slough. |
| QM | Queensland Museum, Fortitude Valley. |
| SAM | South Australian Museum, Adelaide. |
| TM | Természettudományi Múzeum, Budapest. |
| USNM | U.S. National Museum, Washington. |
| ZM | Institut für Spezielle Zoologie und Zoologisches Museum, Berlin. |

In addition to the author's written labels, type-labels as used at the BMNH, London, have been attached to type-specimens. These are small circular labels with the name of the type and a coloured border as follows: holotype, red; paratype, yellow; lectotype, violet; paralectotype, light blue.

## VI. ACKNOWLEDGEMENTS

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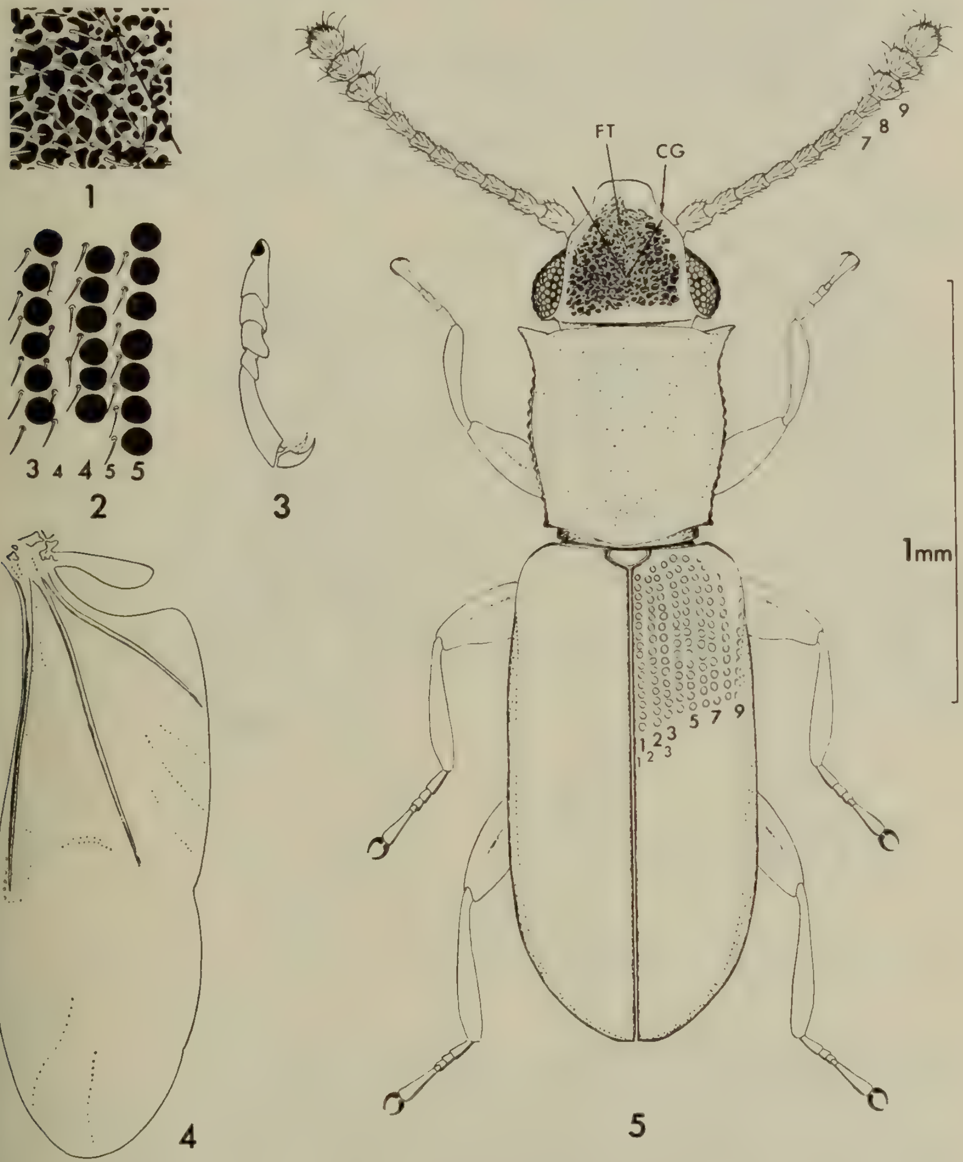


Figs 1–5. *Silvanus lewisi* Reitter. 1, Head puncturation, detail from 5. 2, Strial punctures and setae. 3, Metatarsus. 4, Wing. 5, Dorsal side; FT, frontal triangle, CG, clypeogenal emargination.

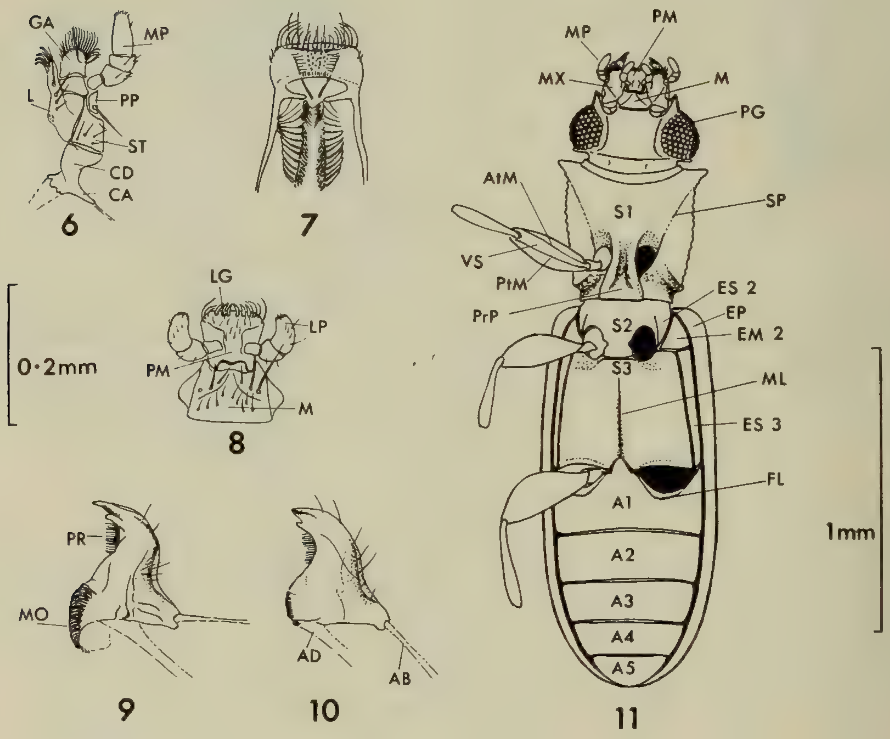
## VII. KEY TO GENERA

1 Antennal segment 8 much narrower than and obviously different from 7 (Text figs 166–169, 176); temple well-defined.

Apical segment of labial palp smaller than previous segment (Text-fig. 131); apex of prosternal process only slightly broader than apex of mesosternum (Text-fig. 149). Ethiopian . . . . ***PARASILVANUS*** Grouvelle (p. 97)

– Antennal segment 8 not much narrower than 7, usually similar to it; temple well- to ill-defined or absent . . . . . . . . . . . . 2

2 (1) Elytral stria 7 moderately to strongly carinate; prosternal process and labial palps as in *Parasilvanus;* antennae may have spines on margins of segments 9 and 10 (Text-fig. 144). Oriental ***PROTOSILVANUS*** Grouvelle (p. 89)



Figs 6–11. *Silvanus lewisi* Reitter. 6, Maxilla. 7, Labrum. 8, Labium. 9, Left mandible, ventral. 10, Right mandible, dorsal. 11, Ventral side.

A 1–5, visible abdominal sternites; AB, tendon of abductor muscle; AD, tendon of adductor muscle; AtM, anterior margin; CA, cardo apodeme; CD, cardo; EM2, epimerite of mesosternum; EP, epipleuron; ES2(3) episternite of S2 (S3); FL, femoral line; GA, galea; L, lacinia; LG, ligula; LP, labial palp; M, mentum; ML, median line; MO, molar lobe; MP, maxillary palp; MX, maxilla; PG, post-gena; PM, prementum; PP, palpiger; PrP, prosternal process; PtM, posterior margin; PR, prostheca; S1–3 pro, meso- and metasternum; SP, sternopleural suture; ST, stipes; VS, ventral side.

– Elytral stria 7 not carinate; apex of prosternal process much broader than apex of mesosternum (Text-fig. 11); apical segment of labial palp larger than previous segment (Text-figs 8, 128); antennae without spines . . . . . . 3

3 (2) Eyes large; temple forming a narrow shelf for eye (Text-fig. 115); puncturation much coarser on pronotum than on head; anterior angles of pronotum little produced, lateral (Text-figs 115, 117); cuticle shining; femoral lines open (see below); ♂ genitalia with parameres as in Text-fig. 123. Oriental **SILVANOIDES** gen. n. (p. 87)

– Eye and temple form not as above, without other characters combined . . 4

4 (3) Femoral lines open, i.e. diverging from margin of metacoxal cavities (Text-fig. 112); anterior margin of pronotum with lateral thirds or less, obviously sloped backwards to anterior angles (Text-figs 109–111, 114).

♂ genitalia, aedeagus with median lobe rounded to very slightly tapered at apex, parameres elongate with long setae, not forked at apex (Text-figs 100, 102, 104, 106). Nearctic and Neotropical **CATHARTOSILVANUS** Grouvelle (p. 81)

– Femoral lines closed, i.e. forming margin of metacoxal cavities (Text-fig. 11); anterior margin of pronotum not as above . . . . . . . 5

5 (4) Genae prominent laterally, triangular; anterior angles of pronotum strongly produced anteriorly, anterior margin concave (Text-figs 96, 97).

♂ genitalia as or similar to Text-fig. 84, parameres rather spatulate at apex; ♂ sternites 8 and 9 as in Text-fig. 88. New Guinea and New Ireland **CALPUS** gen. n. (p. 79)

– Genae not prominent laterally; if anterior angles of pronotum concave on anterior margin, then only moderately produced anteriorly . . . . . . 6

6 (5) Pronotum as in Text-figs 90, 91, 93 and 94, with side margin usually slightly convex where it forms anterior angle; head and pronotum dull, puncturation dense, setiferous punctures ocellate; elytral epipleura with a high inner rim; ♂ genitalia, apex of median lobe extremely broad, parameres as in Text-figs. 81, 83). Nearctic and Neotropical . . . . **PENSUS** gen. n. (p. 77)

– Pronotum not as above; head and pronotum dull or shining, setiferous punctures not or slightly ocellate; elytral epipleura without a high inner rim; ♂ genitalia, apex of median lobe not extremely broad, parameres forked at apex (Text-figs 17–24). World . . . . . . **SILVANUS** Latreille (p. 47)

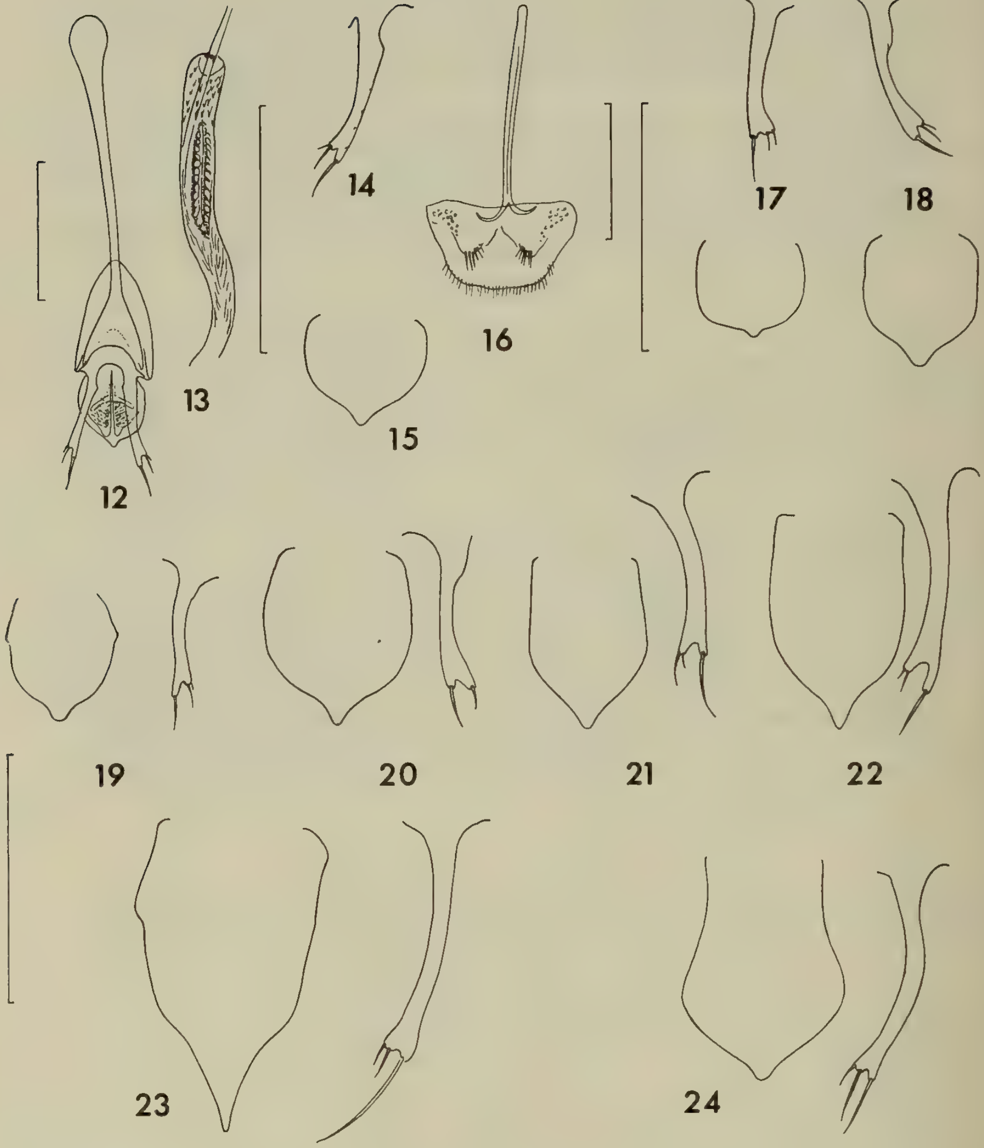
## VIII. DESCRIPTION OF GENERA AND SPECIES, KEYS TO SPECIES

### *Silvanus* Latreille

*Silvanus* Latreille, 1804 : 158. Type-species: *Ips unidentata* Olivier, by monotypy.
*Leptus* Duftschmidt, 1823 : 156. [Duftschmidt knew of Latreille's genus – he renamed it.]

Number of species: 17.

Length 1·83–3·49 mm; body moderately depressed and elongate; yellowish to reddish brown, with fine more or less decumbent golden pubescence. *Head* transverse, dull, densely punctured (e.g., *lewisi*, Text-figs 1 and 5) to shining and comparatively sparsely punctured, clypeus and a somewhat triangular region with apex extending to middle or back of head, in present study called 'frontal triangle' (Text-fig. 5), with puncturation less dense than on rest of head; clypeal margin very slightly emarginate; side of head emarginate where gena meets clypeus – 'clypeo-genal emargination' (Text-fig. 5); genae very slightly or moderately raised dorsally to form a low triangular prominence. *Antennae* 11-segmented, scape broader than segments 2–8, segment



FIGS 12–24. *Silvanus* male genitalia. 12–16, *S. lewisi* Reitter. 12, Male genitalia. 13, Internal sac. 14, Paramere. 15, Median lobe. 16, Sternites 8 and 9. 17–23, Median lobe and paramere. 17, *S. productus* sp. n. 18, *S. difficilis* sp. n. 19, *S. recticollis* Reitter. 20, *S. semus* sp. n. 21, *S. mediocris* Grouvelle. 22, *S. planatus* Germar. 23, *S. robustus* sp. n. 24, *S. rossi* sp. n. Scale lines = 0·2 mm.

8 shorter than 7 but not strongly differentiated from segments 2–7, segment 6 slightly smaller than 7, segments 9–11 broader than other flagellar segments and forming a distinct loose club, apical margins of these segments and apex of 11 with a few setae much longer than others (Text-fig. 5). *Eye* generally large or very large (small in *unidentatus*) and prominent; temples variable, long to very short (from equivalent to nearly one quarter length of eye to less than length of an eye-facet). *Mouth parts* as in Text-figs 6–10, maxillary palps with apical segment (segment 4) at least as long as segments 2 and 3 combined; labial palps with apical segment larger than penultimate; post-genal area variable in breadth. *Thorax* with pronotum almost quadrate to obviously elongate but not more than 1·4 times as long as broad; puncturation as on head; anterior margin almost straight medially, usually sinuate to anterior angles; anterior angles poorly to strongly developed, obtuse to finely tapered; side margins finely serrate (about 15–20 denticles each bearing a seta, denticles becoming obsolete on sides of anterior angles); posterior angles distinct or absent; posterior margin well-defined at sides, ill-defined in middle, not confluent with rim of foramen; surface with sides sloping away from disc to side margin, disc with shallow basal and apical depressions or with lateral longitudinal foveae extending from base to apex on each side of disc (e.g. Text-fig. 66). *Scutellum* transverse. *Prosternum* with sternopleural sutures terminating in anterior angles (Text-fig. 11); procoxal cavities broadly closed behind; prosternal process more or less channelled, obviously broader at apex than between coxae, apex distinctly broader than mesosternal apex. *Metasternum* with median line extending from apex almost to base (Text-fig. 11). *Legs* with tarsi 5-segmented, penultimate segment (segment 4) very small, segment 3 simple (Text-fig. 3); secondary sexual characters exhibited by ♂ as follows: metatibia usually bearing a row of spinules on posterior margin, metafemur with a ridge medially on ventral side (except in *recticollis*), metatrochanter sometimes with a spine. *Elytra* each with 9 rows of punctures forming striae; alternate interstriae with single and double rows of setae as illustrated in Text-fig. 2, not or narrowly explanate at sides; epipleura broad, tapering to apex or sometimes terminating just before it. *Wing* well-developed but venation much reduced, cubitus straight, one anal vein and indication of others, marginal vein (or veins?) terminating in a stigma (Text-fig. 4). *Metendosternite* with broad stem. *First visible sternite of abdomen* (abdominal sternite 3) with femoral line closed, i.e., forming margin of coxal cavity. *Genitalia*, ovipositor with long seta on stylus; aedeagus with median strut spatulate at apex (Text-fig. 12); parameres forked at apex, rather variable within species, usually bearing 1 or 2 setae on each fork, one seta often longer than other two (see Text-figs 17–24); median lobe acuminate (Text-fig. 23) to less strongly tapered and more rounded at apex (Text-figs 17–18) the following species have a median lobe similar to Text-figs 20: *inarmatus*, *proximus*, *castaneus*, *lateritius*, *muticus* and *bidentatus*; internal sac as in Text-fig. 13 or with complex chitinous structure longer; ♂ abdominal sternites 8 and 9 as in Text-fig. 16.

DISTRIBUTION. World.

### KEY TO SPECIES OF *SILVANUS*

1 Head and pronotum as in Text-fig. 43 (sides of pronotum may be slightly more convergent to base).
Dorsal surface shining; puncturation of clypeus and frontal triangle of head fine and rather sparse; eyes large, temple acute; posterior angles of pronotum well-defined. Ethiopian . . . **mediocris** Grouvelle (p. 57)
– Head and pronotum not as above . . . . . . . . . 2
2 (1) Sides of pronotum more or less parallel to apex and anterior angles, as in Text-figs 41–42; antennae somewhat moniliform (Text-figs 39, 40).
Eyes small; dull, small species length 1·69–2·19 mm, general facies characteristic. Oriental and Ethiopian . . . . **recticollis** Reitter (p. 55)
– If sides of pronotum more or less parallel to apex, then anterior angles not as above and eyes larger; antennae not somewhat moniliform . . . 3

3 (2) Anterior angles of pronotum comparatively obtuse, not strongly produced laterally, Text-figs 25–30 . . . . . . . . . . 4

– Anterior angles of pronotum moderately to strongly acute, may be strongly produced laterally, Text-figs 31–38 . . . . . . . . 9

4 (3) Posterior angles of pronotum absent, sides rounded to base (Text-figs 60–61). Length 2·06–2·59 mm. Nearctic . . . ***nitidulus*** LeConte (p. 63)

– Posterior angles of pronotum present . . . . . . . . . 5

5 (4) Pronotum as in Text-figs 44–46; head and pronotum dull; puncturation on frontal triangle similar to that on rest of head . . . . . . 6

– Pronotum as in Text-figs 57, 59; general appearance of head and pronotum either rather dull or shining; interspaces on frontal triangle shining and puncturation obviously different from that at side of head . . . 8

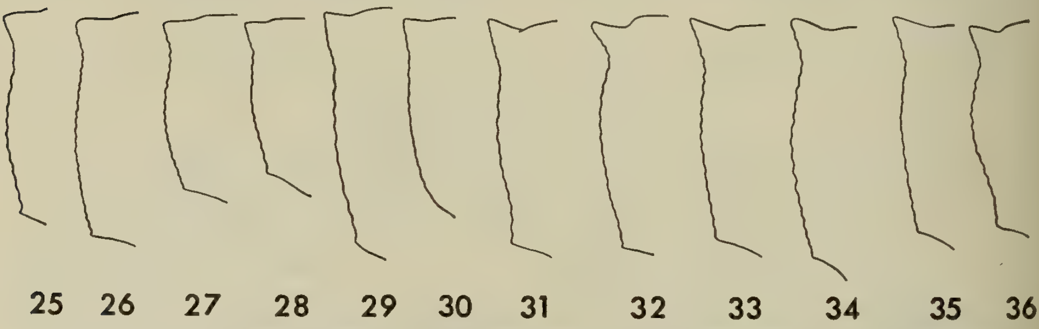
6 (5) Pronotum more elongate, head comparatively larger with relatively large eyes, appearing almost as broad across eyes as pronotum across anterior angles as in Text-fig. 44; head with strongly rugose puncturation and setiferous punctures rather prominent; elytra elongate 2·10–2·16 times as long as broad. Length 2·47–2·87 mm. Ethiopian . . . . ***semus*** sp. n. (p. 58)

– Pronotum less elongate, head and pronotum combined not as in above Text-fig.; puncturation on head not strongly rugose, setiferous punctures not prominent; elytra may be less elongate (1·83–2·10 times as long as broad) . 7

7 (6) Pronotum usually with sides less strongly convergent to base, appearing more quadrate, Text-figs 45 (51–56); prosternal process broadly grooved between coxae, where breadth is two-thirds of apical breadth (Text-fig. 49); elytral epipleura gradually tapered to apex (Text-fig. 47). Ethiopian and associated with stored products . . . . . ***inarmatus*** Wollaston (p. 59)

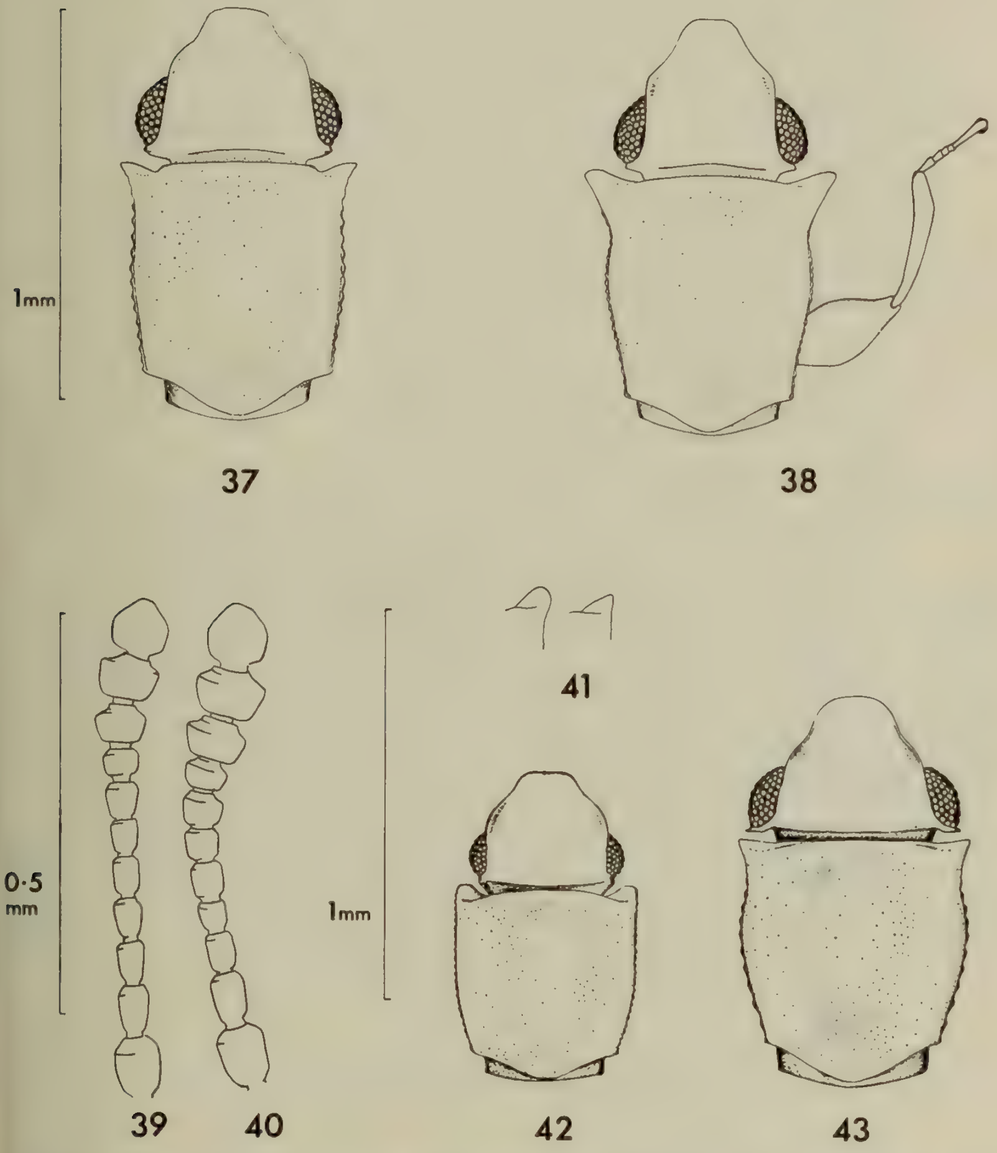
– Pronotum with sides more strongly convergent to base, Text-fig. 46; prosternal process narrowly grooved between coxae where breadth is half of apical breadth (Text-fig. 50); elytral epipleura abruptly tapered before apex, more or less absent apically (Text-fig. 48). Ethiopian and apparently introduced to the Neotropical region; also associated with stored products ***proximus*** Grouvelle (p. 61)

8 (5) Ridge behind eye more pronounced, region comparatively narrower (rather shelf-like), eyes usually more elongate and larger (Text-fig. 58); abdominal sternites 2–5 with coarse setiferous punctures; head and pronotum moderately shining; ventral surface shining; pronotum as in Text-fig. 59 or with sides less convergent to base. Nearctic . . . . . ***planatus*** Germar (p. 64)



FIGS 25–36. *Silvanus*, outline of side of pronotum. 25, *S. semus* sp. n. 26, *S. inarmatus* Wollaston. 27, *S. proximus* Grouvelle. 28, *S. unidentatus* (Olivier). 29, *S. planatus* Germar. 30, *S. nitidulus* LeConte. 31, *S. castaneus* MacLeay. 32, *S. bidentatus* (F.). 33, *S. muticus* Sharp. 34, *S. robustus* sp. n. 35, *S. lateritius* (Broun). 36, *S. difficilis* sp. n.

Ridge behind eye less pronounced, region usually broader; eyes usually less elongate and smaller (Text-fig. 57); abdominal sternites 2–5 with fine setiferous punctures; head and pronotum rather dull; ventral surface dull; pronotum as in Text-fig. 57. Palaearctic and introduced to U.S.A. and Chile.
***unidentatus*** (Olivier) (p. 65)



Figs 37–43. *Silvanus*. 37, *S. rossi* sp. n., head and pronotum. 38, *S. productus* sp. n., head and pronotum. 39–42, *S. recticollis* Reitter. 39, Antenna of specimen from Calcutta. 40, Antenna of specimen from Leopoldville. 41, Variants of anterior angle of pronotum. 42, Head and pronotum. 43, *S. mediocris* Grouvelle, head and pronotum.

9 (3) Pronotum as in Text-fig. 38, anterior angles large and strongly produced; head across eyes: pronotum across anterior angles, 10 : 12·3–12·6.
Eyes large, temple as long as an eye-facet; length of side of pronotal anterior angles at least three-quarters of length of eye. Oriental (one stored-products record) . . . . . . ***productus*** sp. n. (p. 55)

– Pronotum not as above, if similar (i.e. *difficilis*) then anterior angles generally much less produced and head across eyes: pronotum across anterior angles, 10 : 10·6–11·6 . . . . . . . . . . . . . 10

10 (9) Eyes extremely large (Text-fig. 5) separated dorsally, across front, by 1·5–1·7 times their length; temples shorter than an eye-facet.
Pronotum as in Text-fig. 5, sides not strongly convergent to base; ♂ genitalia, Text-fig. 15. Oriental and associated with stored products ***lewisi*** Reitter (p. 53)

– Eyes not extremely large, if pronotum similar (i.e. *rossi*) then eyes separated dorsally, across front, by 1·9–2·1 times their length and temple as long as an eye-facet . . . . . . . . . . . . . 11

11 (10) Anterior margin of pronotum convex and side margin concave where they form anterior angle, sides of pronotum not strongly convergent to base (Text-fig. 37).
Eyes larger, puncturation of frontal triangle not conspicuously different from rest of head; elytra moderately explanate at sides (similar to *lewisi*, Text-fig. 5); genitalia with median lobe expanded before apex (Text-fig. 24). India, Thailand and New Guinea . . . . . . ***rossi*** sp. n. (p. 54)

– Either sides of anterior angles of pronotum entirely different or without above characters combined . . . . . . . . . . . 12

12 (11) Pronotum with sides of anterior angles more or less straight (Text-fig. 62), disc broadly depressed, usually elongate (as illustrated); head with temples as long as an eye-facet, clypeus and frontal triangle with interspaces flat and shining, obviously differentiated from rest of head.
Elytra with sides almost parallel, rounded at apex, not obviously explanate at sides (Text-fig. 62). Australian and Oriental (Singapore) sometimes associated with stored products . . . . . ***castaneus*** MacLeay (p. 66)

– Pronotum not as above; head with temples as long or longer than an eye-facet, frontal triangle with puncturation similar to that on rest of head, not obviously differentiated . . . . . . . . . . . . . 13

13 (12) Anterior angles abruptly developed from side of pronotum, strongly produced laterally, narrow (Text-figs 66, 67); pronotal disc usually with deep (sometimes shallow) well-defined lateral foveae (Text-fig. 66); temples as long as 2 eye-facets or slightly shorter (eye diam.: temple, 4·5–7·4 : 1). Palaearctic and introduced to U.S.A., single specimens seen from India, Thailand and Hawaii (on one occasion found associated with stored products)
***bidentatus*** (Fabricius) (p. 68)

– Anterior angles of pronotum not abruptly developed or if similar, then without above characters combined . . . . . . . . . . 14

14 (13) Pronotum and head as in Text-fig. 68; pronotal disc with well-defined but shallow lateral foveae, anterior angles gradually developed from sides of pronotum, angles with rather straight sides; temples as long as 0·5–1·0 eye facets (eye diameter: temple, 10·5–17·6 : 1); elytra broad (1 : 2·0–2·1), strongly tapered to apex and with lateral margin obviously explanate. Nearctic and Guatemala . . . . . . ***muticus*** Sharp (p. 70)

– Pronotum and head not as in above Text-fig., without above characters combined . . . . . . . . . . . . . 15

15 (14) Lateral margins of elytra obviously explanate; pronotum with sides curved from base to anterior angles, not obviously sinuate before posterior angles

(Text-fig. 75), usually rather gibbous anteriorly, disc with a shallow depression before base; head rather narrow (10·5–11·2 : 10); antennal club segments more quadrate, club appearing more elongate (Text-fig. 77); ♂ genitalia, Text-fig. 23. Oriental . . . . . **robustus** sp. n. (p. 71)

– Either lateral margins of elytra not explanate on basal two-thirds or if so (*difficilis*), then pronotum obviously sinuate before posterior angles and antennal club appearing less elongate (Text-fig. 78) . . . . . 16

16 (15) Eyes smaller, separated ventrally by 2·3–3·7 times breadth; temple as long as 1–1·5 eye-facets; pronotum and head as Text-fig. 63; head broader, 12·0–12·6 : 10; elytra longer, 2·2–2·3 : 1; length 2·47–2·84 mm. Australia, New Zealand and introduced (?) to Madeira and South Africa, sometimes associated with stored products . . . . . . **lateritius** (Broun) (p. 71)

– Eyes larger, separated ventrally by 1·1–2·1 times breadth; temple as long as 1–2·5 eye-facets; pronotum and head as in Text-figs 69–74; head narrower, 10·8–12·0 : 10; elytra shorter, 2–2·1 : 1; length 2·17–2·64 mm. Oriental including Cairns (Australia) and associated with stored products **difficilis** sp. n. (p. 73)

## ***Silvanus lewisi*** Reitter

(Text-figs 1–16)

*Silvanus lewisi* Reitter, 1876 : 57. LECTOTYPE ♂ (here designated, see below), JAPAN (BMNH, London) [examined].

Length 2·07–2·50 mm. Dull, usually yellow-brown. *Head* broader than long (11·5–11·8 : 10) narrower across eyes than pronotum across anterior angles (10 : 11·5–11·7); puncturation coarse and dense, particularly so towards sides and base of head (Text-figs 1 and 5); eyes extremely large and prominent, about half as long as head, longer than twice distance from eye to clypeogenal emargination, separated dorsally, across front, by 1·5–1·7 times their length and ventrally by 1·0–1·5 times their breadth; temples very small, equal to one half or less of an eye-facet diameter. Antennae (Text-fig. 5) with segments 1–6 slightly more elongate than in such species as *unidentatus*. *Pronotum* as in Text-fig. 5 or with sides less sinuate, never strongly convergent to base, longer than broad (11·5–11·9 : 10); puncturation dense, as on head; anterior angles with sides almost straight and apex 'sharp', about half as long as eye; disc slightly depressed towards base and sides; posterior angles almost right angles; wing, Text-fig. 4. *Elytra* (Text-fig. 5) twice as long as broad, setal punctures slightly tuberculate on disc, becoming strongly tuberculate at sides; margins distinctly explanate. *Legs* in ♀ simple; in ♂ metafemur with a low short ridge on anterior margin extending from basal one-sixth to one-third and metatibia with a row of spinules along posterior margin. Metatarsus, Text-fig. 3. *Genitalia* ♂, Text-figs 12–15, ♂ sternites 8 and 9, Text-fig. 16.

Number seen: 80.

Lectotype, present designation, ♂, length 2·67 mm, with 'Type [ptg., circular red-bordered label]/Type 5.3.76 [circular label]/Japan G. Lewis 1910 – 320/5.3.76/ Lewisi Reitt.'.

COMPARATIVE NOTES. A rather distinct species, due to its large eyes. It is most closely related to three new species: *rossi*, *productus* and *difficilis*. Its large eyes and very small temples distinguish it from *rossi* and *difficilis* and its pronotal form from *productus*.

DISTRIBUTION. Oriental, including N. Queensland of Australia, and apparently introduced to and imported from the Ethiopian region. INDIA: Madhya Pradesh – Sendhara, South India – Cinchona (Anaimalai Hills), Coimbatore, Dohnavur, Kanara, Mysore; CEYLON: Kandy; CHINA: Kwangchow [Canton]; VIETNAM (SOUTH): Prov. Nghe-An and Saigon; TAIWAN: Taihoria; JAPAN (type-locality); WEST MALAYSIA: Kuala Lumpur; SINGAPORE: Seletar (another record 'Singapore' and found on imports to Britain from Singapore); JAVA: Soekaboemi; BORNEO: North – Upper Kinabatangan R, South East – Martapura; PHILIPPINES: Mindanao; NEW GUINEA: Cyclops Mts (Sabron), Finschhafen and Hollandia; SOLOMON IS: Guadalcanal Kukum; AUSTRALIA: N. Queensland, Cardstone; CONGO: Brazzaville; GHANA: Komenda and Pretsea. In BMNH, London; CAS, California; MF, Munich; TM, Budapest; PICL, Slough; ZM, Berlin; and Australian specimens in ANIC, Canberra.

HABITATS. *S. lewisi* is often imported to Britain in small numbers on stored products or on dunnage, usually from the Oriental region but also from Africa. Desiccated coconut from Ceylon often harbours this species and it has been found on tapioca flour from Thailand and on rice and pulses probably from Burma, etc. African records include residues of bark and gum arabic, Nigerian groundnut kernels and red beans from Mombasa.

This species has been collected at light (Vietnam and West Malaysia) and under bark of tree stumps (Singapore). In Ghana it has been collected on freshly fallen coconut palms.

## ***Silvanus rossi* sp. n.**

(Text-fig. 37)

Length 2·29–2·58 mm. Facies and puncturation as *lewisi* but darker than usual for this species. *Head* broader than long (11·3–11·7 : 10) narrower across eyes than pronotum across anterior angles (10 : 11·1–11·7); puncturation dense, frontal triangle not conspicuous; eyes slightly less than half as long as head, length of eye less than twice distance from eye to clypeogenal emargination, eyes separated ventrally by at least twice their breadth, dorsally, across front by 1·9–2·1 times their length: temples as long as an eye-facet. *Pronotum* (Text-fig. 37) similar to *lewisi*, longer than broad (10·0–12·3 : 10). *Elytra* 2·2–2·1 times as long as broad. *Legs* in ♀ simple; in ♂ metafemur with a short low ridge towards base of middle third of ventral side and metatibia with a row of spinules on posterior margin. *Genitalia* ♂, median lobe more elongate than in *lewisi*, expanded before tapering to apex (Text-fig. 24).

Holotype ♂, length 2·56 mm, INDIA: W. Almora Divn, Kumaon, U.P. iii. 1917 (*H. G. Champion*) 548, in BMNH, London.

Paratypes (6). 1 ♀ with the same data as holotype; 1 ♂ from the same locality but collected by Champion, ii. 1916 and with the number 487e; 1 ♂ with same data but without date; 1 ♂, 1 ♀, THAILAND: E. slope Doi Sutep, 1100–1275 m, 15.vii.1962 (*E. S. Ross and D. Cavagnaro*). Indian paratypes in BMNH, London; Thailand paratypes in CAS, California. 1 ♀, NEW GUINEA: Wum, Upper Jimmi V., 840 m, light trap, 18.vii.1955 (*J. L. Gressitt*), in BPBM, Honolulu.

Comparative notes. Very closely related and similar to *lewisi* but may be distinguished by its smaller eyes and larger temples. Other minor differences, only of value when *lewisi* is available for comparison, are found in the pubescence, which is less obvious in *rossi*, the anterior angles of the pronotum, which are usually a little less tapered in *rossi* and the antennae which are slightly less elongate in this new species. The form of the pronotum distinguishes it from *difficilis*.

Distribution. Oriental; India, Thailand and New Guinea.

## ***Silvanus productus* sp. n.**

(Text-figs 17, 38)

Length 2·00–2·36 mm. Puncturation and antennae as in *lewisi*. *Head* broader than long (11·5–11·9 : 10), much narrower across eyes than pronotum across anterior angles (10 : 12·3–12·6); eyes separated ventrally by less than twice their breadth, dorsally by about twice their length; temples as long as an eye-facet. *Pronotum* as in Text-fig. 38, longer than broad (12·9–13·3 : 10); anterior angles strongly produced (diagnostic for the species) nearly as long as an eye (equal to at least three-quarters of its length); disc moderately depressed near apex and at sides, more strongly depressed towards base. *Elytra* 2·0–2·1 times as long as broad, similar to elytra in *lewisi*. *Legs*. Femora (Text-fig. 38) broader than in *lewisi;* in ♀ legs simple, in ♂ metafemur with a prominent ridge along anterior margin, extending from basal quarter to one half. Metatibia with spinules along posterior margin. *Genitalia* ♂, Text-fig. 17.

Holotype ♂, length 2·36 mm, Singapore: Bukit Timan Nat. Res., under bark of standing dead tree, 13.xi.1966, in BMNH, London.

Paratypes (4). 1 ♀, with same data as holotype; 1 ♂, West Malaysia: Johore, Kluang saw mills, 12.vii.1932, this and the previous specimen in BMNH, London; 1 ♀, collected on Malaysian sago flour imported to Britain, H 2869, 1971 (*T. Rhynehart*), in PICL, Slough; 1 ♀, Java: Batavia [Jakarta], 1898 (*Biró*), in TM, Budapest.

Comparative notes. This species is closely related to *lewisi* and *difficilis*, and some forms of the latter are very similar. Generally it may be distinguished from both by the shape of the anterior angles of the pronotum and by the pronotal width across these angles relative to head width across eyes. Forms of *difficilis* with similar anterior angles may be distinguished by the head which appears relatively larger and the epipleura which are slightly more tapered to the apex than in *productus*.

Distribution. Oriental; West Malaysia, Singapore and Java.

Habitats. See type-designations.

## ***Silvanus recticollis* Reitter**

(Text-figs 19, 39–42)

? *Leucohimatium breve* Wollaston, 1873 : 170. Holotype sex indet., Japan [Dr S. Hisamatsu brought the description of this species to my attention; it is almost certainly the same species as *recticollis* but I have failed to locate the type, which is said to be in the BMNH, London.]

*Silvanus recticollis* Reitter, 1876 : 61. LECTOTYPE (here designated, see below), JAPAN (BMNH, London) [examined].

*Silvanus reflexus* Reitter, 1880 : 25. Holotype sex indet., SICILY (ZM, Berlin) [examined.] **Syn. n.**

*Silvanus vitulus* Grouvelle, 1882 : 294. Holotype sex indet., SULAWESI [Museo Civico di Storia Naturale, Genoa – Dr D. Guiglia compared the type with *recticollis* at author's request]. **Syn. n.**

*Silvanus* (*Microsilvanus*) *vitulus* Grouvelle; Grouvelle, 1912 : 332.

*Silvanus* (*Microsilvanus*) *pumilus* Grouvelle, 1912 : 332. LECTOTYPE (here designated, see below), THAILAND (MNHN, Paris) [examined]. **Syn. n.**

*Silvanus* (*Microsilvanus*) *minimus* Grouvelle, 1912 : 334. LECTOTYPE (here designated, see below), VIETNAM (SOUTH) (MNHN, Paris) [examined]. **Syn. n.**

Length 1·69–2·19 mm. Small, dull species. *Head* (Text-fig. 42) slightly broader than long (10·5–11·4 : 10), narrower across eyes than pronotum across anterior angles (10 : 11·2–12·0); vertex densely punctured with coarse punctures (as long as an eye facet or less) and finer setiferous punctures on interspaces, clypeus less densely punctured; genal margins raised; antennae with segment 8 almost quadrate to distinctly transverse, tending to be more transverse in African specimens (Text-figs 39–40). *Pronotum* (Text-fig. 42) slightly longer than broad, appearing quadrate (length : breadth, 10·1–10·8 : 10); puncturation as on vertex of head; anterior angles produced anteriorly, usually somewhat rounded apically as in Text-fig. 42, to very slightly produced laterally (Text-fig. 41, left-hand figure); disc moderately depressed towards base, apex and sides; disc of *mesosternum* slightly depressed. *Elytra* 1·8–1·9 times as long as broad. *Ventral puncturation*, head and mesosternum similar to vertex of head, disc of metasternum and 1st abdominal sternite, and whole of other sternites with finer puncturation. Apparently without secondary sexual characters. *Genitalia* ♂, median lobe and paramere, Text-fig. 19.

Number seen: 30.

I have not seen the types of *vitulus* Grouvelle but Dr D. Guiglia (Genoa Museum) has kindly compared a specimen of *recticollis* with Grouvelle's type. I believe that *reflexus* (undoubtedly imported to Sicily), *vitulus*, *pumilus* and *minimus* are synonymous with *recticollis*.

Lectotype of *recticollis* Reitter, present designation, length 2·25 mm, sex indet., with 'Type H.T. [ptg., circular red-bordered label]/Japan G. Lewis 1910–320/ Japan m. recticollis [MS label]'.

Lectotype of *pumilus* Grouvelle, present designation, length 1·88 mm, sex indet., with 'Siam C$^{n}$. Casteln [Grouvelle's MS]/Type [ptg., on pink label]/pumilus Grouv. [Grouvelle's MS]', left hand specimen on card mount. Paralectotype 1·60 mm, right hand specimen on same mount as lectotype.

Lectotype of *minimus* Grouvelle, present designation, length 2·19 mm, sex indet., with 'Saigon [Grouvelle's MS]/Type [ptg., on pink label]/minimus Grouv. [Grouvelle's MS]', left hand specimen on card mount. Paralectotype, length 2·14 mm, right hand specimen on same mount as lectotype.

COMPARATIVE NOTES. The general facies of head and pronotum, combined with small size, readily distinguishes this species from all others, hence most of the species synonymized here were placed in a separate subgenus, *Microsilvanus*, by Grouvelle (1912) (see page 41 of the present study). Subgenera have not been used in this revision.

DISTRIBUTION. Oriental and Ethiopian. INDIA: Calcutta (MNHN, Paris); THAILAND (type-locality); VIETNAM: Saigon (type-locality) and Hanoi (TM, Budapest); LAOS: Annaur (TM, Budapest); SULAWESI: Makassar (type-locality); JAPAN (type-locality) and more recently collected in Matsuyama; RYUKYU IS: Iriomote (Ehime University collection). MAURITANIA: Bafrechie (IFAN, Dakar); CONGO: Brazzaville; ZAIRE: Garamba, Kivu, Leopoldville (TM, Budapest and IRSNB, Brussels); RHODESIA: Wankle National Park (BMNH, London).

HABITATS. This species has been collected at light in both the Oriental and Ethopian regions.

## ***Silvanus mediocris*** Grouvelle

(Text-figs 21, 43)

*Silvanus mediocris* Grouvelle, 1889 : 106. Holotype sex indet., IVORY COAST (MNHN, Paris) [examined].

Length 2·16–2·49 mm. General appearance smooth and shining. *Head* broader than long (12·8–13·0 : 10), across eyes narrower than across pronotal anterior angles (10 : 10·6–11·0); clypeus and frontal triangle which extends to back of vertex, with rather sparse fine punctuation – punctures about one-fifth of eye-facet diameter, smooth and shining; sides of head with large irregular punctures, comparatively rough but shining, interspaces with very fine setiferous punctures which sometimes have margins raised, setae about twice eye-facet diameter; eyes large, very prominent; temples acute, equivalent to an eye-facet diameter, or slightly more. *Pronotum* shining, longer than broad (11·4–12·1 : 10), form as in Text-fig. 43, with large punctures, breadth as much as twice eye-facet diameter and fine setiferous punctures on narrow interspaces; sides appearing rugose; anterior angles acute; disc depressed towards base and slightly towards apex; posterior angles obtuse; ratio of breadth of pronotum across posterior angles to that across elytral humeri, 10 : 15·3–16·3; prosternal process as in *proximus*. *Elytra* 2·04–2·09 times as long as broad, shining, disc moderately depressed; setiferous punctures sometimes somewhat tuberculate, setae shorter than those on head; epipleura similar to *proximus* but elytral apex not terminating in a distinct tooth. *Legs*. Metafemur in ♀ simple, in ♂ ventral side with a lamellate ridge obliquely traversing median one-third; metatibia without secondary sexual characters. *Genitalia* ♂, median lobe and paramere, Text-fig. 21.

Number seen: 12.

Holotype of *mediocris* Grouvelle with 'Assinie Cote occid. Afrique Ch. Alluaud 1886 [ptg.]/Type [ptg.]/Silvanus mediocris Grouv./S. mediocris Grouv. ty.', unique. Although in the original description there is no indication of the number of specimens seen, Grouvelle (1892*b*) referring to his description states 'Assinie, 1 exempl.'.

COMPARATIVE NOTES. The form of the head and pronotum and the shining appearance distinguish this species.

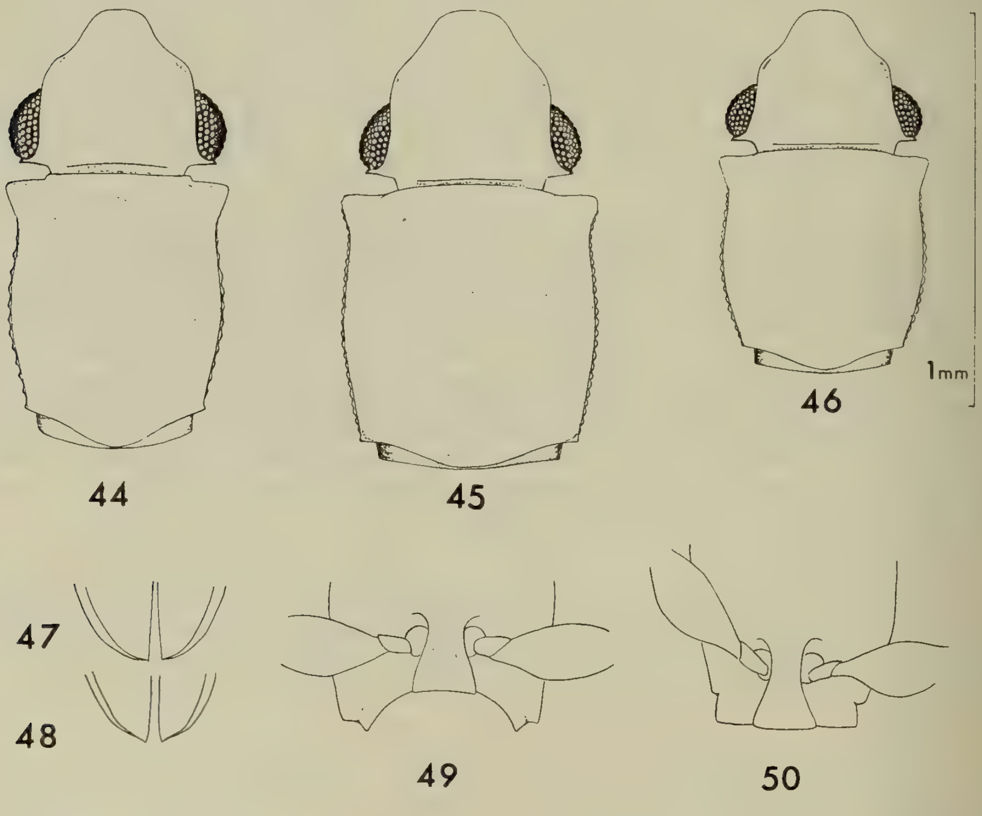
DISTRIBUTION. Ethiopian. IVORY COAST: Assinie (holotype) and Tonkoui; GHANA: Kumasi; NIGERIA: Ile-Ife; CAMEROUN; ZAIRE: Dimonika, Eala, Kivu, Lulongo and 59 km S of Tshela; UGANDA: Ruwenzori Range, Semliki Forest. In BMNH, London; CAS, California; IFAN, Dakar; MNHN, Paris; MRAC, Tervuren; PICL, Slough; TM, Budapest.

HABITAT. In forest humus (Zaire) and at light (Ghana).

### ***Silvanus semus*** **sp. n.**

(Text-figs 20, 44)

Length 2·47–2·87 mm. *Head* slightly broader than long (10·8–11·3 : 10); not or slightly narrower across eyes than across pronotal anterior angles (10 : 10·0–10·7); surface dull, punctuation rugose with prominent narrowly ocellate, setiferous punctures (breadth including rim one half of eye-facet diameter) situated on narrow interspaces of coarse punctures – largest of these being as broad as an eye-facet; setae two to three times eye-facet diameter; eyes moderately prominent; temples acute, length equal to an eye-facet diameter, or slightly less. *Pronotum* longer than broad (12·4–12·6 : 10), Text-fig. 44; dull, with punctuation similar to head but margins of setiferous punctures not so obviously raised, at sides punctuation particularly



FIGS 44–50. *Silvanus*. 44, *S. semus* sp. n., head and pronotum. 45, 47, 49, *S. inarmatus* Wollaston. Head and pronotum, elytral apices (ventral) and base of prosternum (for prosternal process). 46, 48, 50, *S. proximus* Grouvelle, same.

coarse and dense; anterior angles as in Text-fig. 44, not produced beyond anterior margin; disc depressed towards base and apex, median area slightly raised; posterior angles more or less acute; ratio of breadth of pronotum across posterior angles to that across elytral humeri, 10 : 15·2–16·1; prosternal process similar to *proximus*. *Elytra* 2·10–2·16 times as long as broad, disc not depressed; interspaces and interstriae with tuberculate setiferous punctures, setae a little shorter than those on head; epipleura as in *proximus* but never terminating in a strong tooth. *Legs*. Metafemur and metatibia simple in ♀; in ♂ metafemur with a low ridge obliquely traversing ventral side from basal one quarter to one half and metatibia with a row of spinules as in *proximus*. *Genitalia* ♂, Text-fig. 20.

Holotype ♂, length 2·69 mm, SOUTH AFRICA: Port St John, Pondoland (Cape of Good Hope), ix.1923 (*R. E. Turner*), in BMNH, London.

Paratypes (31). 15 ♀, 16 ♂ with the same data as the holotype; 1 ♂, MADAGASCAR: Perinet sur Varongy, 16.i.1964 (*Brunk*) Col. CTFT No. 115. Six in PICL, Slough, rest in BMNH, London.

COMPARATIVE NOTES. Very closely related to *proximus* but comparatively larger with more elongate pronotum of different form, having more pronounced anterior angles and less obtuse posterior angles. The pronotal form is also somewhat similar to that in the Oriental *difficilis* sp. n. but differs in not having the anterior pronotal angles produced beyond the anterior margin.

## ***Silvanus inarmatus*** Wollaston

(Text-figs 45, 47, 49, 51–56)

*Silvanus inarmatus* Wollaston, 1867 : 69. LECTOTYPE ♂ (here designated, see below), CAPE VERDE IS. (BMNH, London) [examined].

*Silvanus quadraticollis* Reitter, 1876 : 62. LECTOTYPE (here designated, see below), MADAGASCAR (MNHN, Paris) [examined]. **Syn. n.**

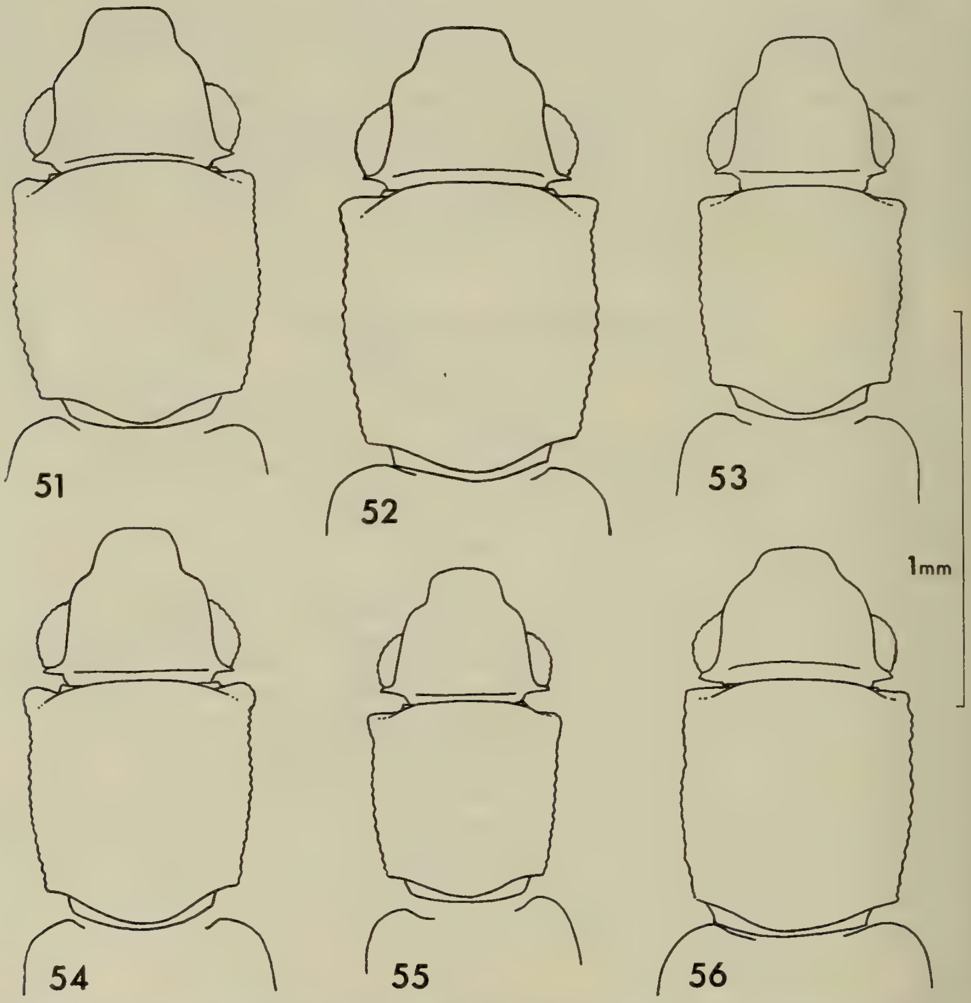
*Silvanus hebetatus* Grouvelle, 1912 : 339. LECTOTYPE ♂ (here designated, see below), TANZANIA (BMNH, London) [examined]. **Syn. n.**

Length 1·95–2.73 mm. *Head* broader than long (12·1–12·7 : 10) appearing much narrower than prothorax (ratio of breadth across eyes to that across pronotal anterior angles, 10 : 11·2–11·5); dull with punctures variable in size (diameter, equal to one half of eye-facet or less), most separated by not more than one half of diameter, some confluent, interspaces with fine setiferous punctures, setae as long as twice diameter of eye-facet; eyes large, moderately prominent; temples acute, as long as or slightly shorter than diameter of an eye-facet. *Pronotum* variable in form, almost quadrate to more obviously trapezoid, length : breadth 10·9–11·6 : 10 (Text-figs 45, 51–56); dull with punctures larger than eye-facets, interspaces very narrow, setation as on head; anterior angles more or less rounded, sometimes almost right-angles (e.g. Text-fig. 56); disc shallowly to moderately depressed towards base and apex; posterior angles almost right-angles, slightly raised dorsally, ratio of breadth of pronotum across posterior angles to that across elytral humeri, 10 : 13·1–13·4; *prosternal process* broadly grooved between coxae where breadth is two thirds of apical breadth (Text-fig. 49). *Elytra* 2·04–2·10 times as long as broad, disc moderately depressed; interstriae and interspaces with fine tuberculate setiferous punctures, setae slightly shorter than those on head; epipleura more or less flat, gradually tapered to apex (Text-fig. 47). *Legs*. In ♀ metafemur simple and metatibia as in *proximus* or slightly more expanded apically but without a row of spinules; in ♂ metafemur with a low ridge on anterior margin which extends from basal quarter to half, metatibia distinctly expanded from basal third to apex and bearing a row of spinules on posterior margin.

Number seen: 154.

Lectotype of *inarmatus* Wollaston, present designation, ♂, length 2·98 mm, with 'Type [BM circular, red-bordered label]/inarmatus, Woll. [MS]'. No locality data, in Wollaston's Cape Verde collection in BMNH, London, a small black paint mark traversing the right-hand corner of the card mount – Wollaston's mark denoting S. Iago as the locality. Paralectotypes of *inarmatus*, 6 with a black paint mark as the lectotype, BMNH, London.

Lectotype of *hebetatus* Grouvelle, present designation, ♂, length 2·51 mm, with 'Type [BM circular red-bordered label]/Caia Zambesi H. Swale/Bark/Silvanus hebetatus ty Grouv. [Grouvelle's MS]/27.6.10 Caia H. Swale/Type [orange label



FIGS 51–56. *Silvanus inarmatus* Wollaston, head and pronotum. 51, Rhodesian specimen ♀. 52, Nigerian specimen ♀. 53, Rhodesian specimen ♂. 54–56, Zaire specimen ♀, ♀, ♂.

ptg.]'. Paralectotype of *hebetatus*, 1 ♀ with 'Caia H. Swale/Type [pink label ptg.]/ S. hebetatus Grouv. ty', MNHN, Paris.

Lectotype of *quadraticollis* Reitter, present designation, sex indet., length 2·37 mm, with 'Madagascar Rollenberg/quadraticollis m. Madagas [Reitter's MS]/ quadraticollis Rtt/Ex Coll. Reitter'. There is no type-material of this species in the TM, Budapest. The above specimen is in the Oberthür collection, MNHN, Paris.

COMPARATIVE NOTES. Closely related to *proximus*. In addition to characters given in the key, the following are useful in distinguishing *inarmatus* from *proximus* (i) usually more elongate, (ii) eyes less prominent, (iii) base of pronotum comparatively broader, (iv) pronotum with posterior angles nearly right-angles and raised dorsally, whereas in *proximus* they are obviously obtuse and not raised and (v) elytra obviously depressed and slightly more elongate.

DISTRIBUTION. Ethiopian. CAPE VERDE IS: S. Iago (types); GUINEA: N'Zérékoré; IVORY COAST: Tonkoui; GHANA: widely distributed; TOGO: Mt Togo, Klouto 800 m; NIGERIA: Ile-Ife and 'Nigeria'; CAMEROUN: Victoria; GABON: Pointe Noire; ZAIRE: widely distributed (reference numbers of specimens collected in the Parc National de la Garamba (see p. 43) 2208, 2841, 2918, 2930, 3519, 3738, 3774, 3823, 2932, 4007); ANGOLA: Baia Farta, Camaxilo and Dundo; UGANDA: Ruwenzori Range, Semliki Forest; KENYA: Ikutha, Kijabe and Ramisi; TANZANIA: 52 mls N.E. Iringa and Neu Moschi; MOZAMBIQUE: Caia (types of *hebetatus*); SEYCHELLES; MADAGASCAR (type-locality of *quadraticollis*): Maroantse-tra-ville and Ambodiwangy; ZAMBIA: Shigariatombwes and Mwengwa; RHODESIA: Matabeleland; SOUTH AFRICA: Cape Province and Transvaal nr Messina. In BMNH, London; CAS, California; IRSNB, Brussels; IFAN, Dakar; MD, Dundo; MF, Munich; MNHN, Paris; MRAC, Tervuren; TM, Budapest.

HABITATS. Occurs sporadically in association with stored products of African origin – probably often as a cross-infestation from dunnage. It has been collected at light, on maize heads (several records), fruits and under bark of *Ficus* and there are many records from beneath bark or associated with dead branches of various trees.

## ***Silvanus proximus*** Grouvelle

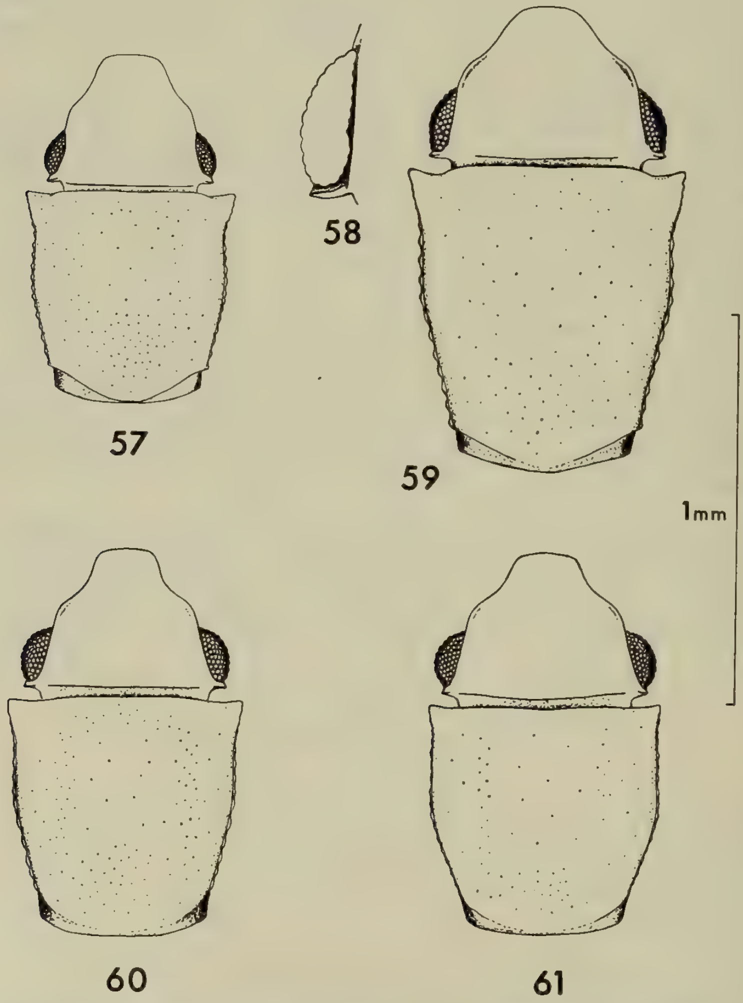
(Text-figs 46, 48, 50)

*Silvanus proximus* Grouvelle, 1904 : 183. LECTOTYPE ♂ here designated, see below), CAMEROUN (MNHN, Paris) [examined].

*Silvanus amabilis* Grouvelle, 1914 : 140. Holotype, sex indet., ZAIRE (MRAC, Tervuren) [examined]. **Syn. n.**

Length 1·83–2·39 mm. *Head* a little broader than long (11·3–11·8 : 10) slightly narrower across eyes than pronotum across anterior angles (10 : 10·6–10·9); dull, puncturation similar to *inarmatus* but margins of setiferous punctures raised, producing a more rugose appearance; eyes large, prominent; temples acute, about as long as an eye-facet. *Pronotum* (Text-fig. 46) slightly longer than broad (10·7–11·5 : 10), sides moderately convergent to posterior angles; appearance dull, puncturation as in *inarmatus;* anterior angles more or less acute, disc depressed at base and slightly towards apex; posterior angles obtuse, not raised dorsally, ratio of breadth of pronotum across posterior angles to that across elytral humeri (10 : 14·9–15·7); *prosternal process* narrowly grooved between coxae, where breadth is half of apical breadth (Text-fig. 50). *Elytra* 1·83–1·96 times as long as broad, convex in section (disc not depressed) punctuation and setation as in *inarmatus;* epipleuron, by junction of abdominal sternites 4 and 5, becoming abruptly more tapered and declivous to apex, more or less absent apically, the elytral apex produced and often forming a distinct tooth (Text-fig. 48). *Legs.* Metafemur and metatibia in ♀ simple; in ♂ metafemur with a low ridge on basal half of anterior margin and metatibia with a row of spinules on posterior margin.

Number seen: 245.



Figs 57–61. *Silvanus*, head and pronotum. 57, *S. unidentatus* (Olivier). 58–59, *S. planatus* Germar. 58, Eye. 60–61, *S. nitidulus* LeConte. 60, Specimen from Maryland. 61, Specimen from Arizona.

Lectotype, present designation, ♂, length 2·12 mm, with 'Albrechts-Höhe Cameroun [MS violet ink on blue paper]/Type [MS violet ink on white paper]/proximus Grouv.', all Grouvelle's MS. One paralectotype ♂ with same data as lectotype, also in MNHN, Paris. Syntypes from ZAIRE, 'Kinchassa (Waelbroek)' were not found.

COMPARATIVE NOTES. This species is very similar to *inarmatus* and the Palaearctic *unidentatus*. It may be distinguished from *inarmatus* as described in the key and 'Comparative notes' for that species. It has larger eyes, denser puncturation on the clypeus and frontal triangle, pronotum with less convergent sides and shorter, more acuminate elytra than in *unidentatus*.

DISTRIBUTION. Ethiopian and apparently introduced to the Neotropical region. GUINEA: Mt Nimba; SIERRA LEONE; IVORY COAST: Tonkoui; GHANA: widely distributed; CAMEROUN (type-locality); GABON; ZAIRE (type-locality for *proximus* and *amabilis*): widely distributed; SOUTH WEST AFRICA: nr Outjo; TANZANIA: Neu Moschi, recorded by Grouvelle (1923), specimens examined, and Lake Manyara. Ethiopian material in BMNH, London; CAS, California; IFAN, Dakar; IRSNB, Brussels; MNHN, Paris; MRAC, Tervuren; TM, Budapest. MEXICO: Tres Zapote (in USNM, Washington); VENEZUELA: Caracas (in ZM, Berlin); BRAZIL (see below, in PICL Slough); WEST INDIES: St. Thom[as Is.], Martinique and Grenada (in ZM, Berlin and BMNH, London).

HABITATS. Occurs occasionally in association with stored products imported to Britain from Africa and one specimen was found on brazil-nut residues in a ship carrying nuts from Belon, Brazil. It has been sifted from oil-palm fruits, *Elaeis* (Congo 106 specimens, Ghana 98 specimens), caught at light and found in humus and forest-litter.

## ***Silvanus nitidulus*** LeConte **sp. rev.**

(Text-figs 60, 61)

*Silvanus nitidulus* LeConte, 1854 : 78. LECTOTYPE (here designated, see below), U.S.A.: California (MCZ, Massachusetts) [examined]. [Regarded as synonymous with *Silvanus planatus* Germar by Hetschko, 1930.]

Length 2·06–2·59 mm. This is a small and extremely variable species. It appears to represent a polytypic species in the sense of Mayr, Linsley & Usinger (1953). The extreme forms (specimens seen from Arizona and Maryland) are distinct and may be separated by using characters provided by the form of the pronotum and the puncturation of the head, but intermediate forms exist (specimens seen from Central Mexico and Utah). *Head* broader than long (12·6–14·5 : 10), slightly to obviously narrower across eyes than pronotum across anterior angles (10 : 10·2–11); puncturation on clypeus and frontal triangle extremely variable, sparser than in *planatus*: either puncturation fine, predominantly setiferous, punctures separated by 4–5 diameters, interspaces with strong reticulation (Arizona and California specimens) or at the other extreme less predominantly setiferous, finer and coarser simple punctures also present and consequently puncturation denser, interspaces with ill-defined to moderately distinct reticulation; eyes rather flat (Text-fig. 60, Maryland) to prominent (Text-fig. 61, some specimens from Arizona), ratio of length to breadth, 2·8–2·4 : 1; temple as long as 1–1·5 eye-facets. *Pronotum* variable, extreme forms illustrated in Text-figs 60, 61, longer than broad (10·4–

11·3 : 10); anterior angles feebly developed to almost absent (Arizona and C. Mexico specimens); disc depressed and with a narrow, longitudinal, slightly raised, sparsely punctured region in the middle; sides with strong rugose puncturation; posterior angles absent, sides rounded to base; basal margin ill-defined. *Elytra* 2·1–2·2 times as long as broad, strial puncturation not quite as deep as in *planatus*. *Legs* in ♀ simple, in ♂ metatibia with a row of very small spinules on posterior margin, metafemur simple. *Genitalia* ♂, similar to *planatus*.

Number seen: 150.

Lectotype, present designation, sex indet., length 2·19 mm, with a gold card disc and 'Type 6775 [red label]/S. nitidulus Colorado Lec'. LeConte gives 'Colorado River California under poplar bark' as the type-locality but no indication of the number of specimens he had before him when describing the species. I am assuming that 'Colorado' stands for Colorado River.

COMPARATIVE NOTES. This species is closely related and similar to *planatus*, a species with which it has been synonymized (Hetschko, 1930 etc.) and the general facies of some specimens may lead to confusion with *unidentatus*. It can be distinguished from *planatus* by its pronotal form, particularly the lack of posterior angles, smaller size and comparatively sparser puncturation on head, prosternum and mesosternum.

DISTRIBUTION. Nearctic: CANADA, U.S.A. and CENTRAL AMERICA. Alberta: Medicine Hat; California: Davis, Red Bluff, Kern Co. (USNM, Washington); Utah: Roesmith, N. Logan (USNM, Washington); Colorado: Littleton; Arizona: Tacna (40 ex.), Tuson (USNM, Washington), Benson, Cibola, Globe; Nebraska: Lincoln (35 ex.), Malcolm; Iowa: Iowa City, Independence; Kansas: Onagra, Wathena (USNM, Washington); Oklahoma: Cleveland Co; Texas (BMNH, London); New York: Pelham (USNM, Washington); Pennsylvania: Darby; Maryland: nr Plumer Is, Washington Co., Clear Springs (USNM, Washington), Takoma Park; CENTRAL MEXICO (USNM, Washington). Unless stated otherwise, specimens are in CAS, California.

### ***Silvanus planatus*** Germar

(Text-figs 22, 58, 59)

*Silvanus planatus* Germar, 1824 : 466. Type(s), NORTH AMERICA [not examined].

*Silvanus zimmermanni* Guérin-Méneville, 1844 : 198. Type(s), U.S.A.: Carolina [not examined]. [Syn. teste Leng, 1920 : 198, etc.]

*Silvanus cognatus* LeConte, 1854 : 77. LECTOTYPE (here designated, see below), U.S.A.: Georgia (MCZ, Massachusetts) [examined].

Length 2·31–2·82 mm. Ventral surface strongly shining. *Head* broader than long (12·7–13·9 : 10), narrower than pronotum (ratio of breadth across eyes to that across pronotal anterior angles 10 : 11·6–11·8); clypeus and frontal triangle, which extends to back of head, very unevenly punctured (punctures separated by 2–5 diameters, mainly setiferous), interspaces strongly shining; sides of head with dense puncturation, rugose by eyes; eye and temple as in Text-fig. 58, eyes rather flat, usually obviously elongate (2·9–2·6 times as long as broad); temple as long as 1–1·5 eye-facets. *Pronotum* longer than broad (11·0–11·8 : 10), form similar to that in *unidentatus* but frequently more obviously depressed and anterior angles usually more tapered to apex (Text-fig. 59); puncturation dense but often with a more sparsely punctured region along mid-line, interspaces strongly shining; disc slightly depressed towards base; posterior angles obvious. *Elytra* 2·13–2·24 times as long as broad, similar to *unidentatus* except as described in 'Comparative notes' below. *Abdominal sternites* with coarse setiferous punctures separated by 1–2 diameters. *Legs* in ♀ simple; in ♂, metatrochanter with a prominent spine, metafemur with a lamellate ridge traversing median third of ventral side, metatibia with a row of spinules on posterior margin. *Genitalia* ♂, Text-fig. 22.

Number seen: 194.

Lectotype of *cognatus* LeConte, present designation, sex indet., length 2·71 mm, bearing an orange disc and 'Type 6776 [red label]/S. cognatus Ga Lec'.

COMPARATIVE NOTES. This species is very similar to the American *nitidulus* and Palaearctic *unidentatus*. For the former species see 'Comparative notes'. In addition to the ridge and eye character which is sometimes difficult, the abdominal puncturation and the shining appearance of *planatus* (see key), the following comparative characters may be used to distinguish it from *unidentatus:* (i) antennal segment 10 (second club-segment) more transverse; (ii) pronotum more depressed, and when present, impunctate area may be much broader than 1–2 punctures; (iii) prosternal process behind procoxa comparatively broader; (iv) elytra more acuminate, strial punctures slightly larger and deeper; and (v) in ♂, metatrochanter with a spine, and ridge on metafemur less prominent.

DISTRIBUTION. Nearctic. CANADA: Ontario, Quebec and 'Canada W' (in BMNH, London). U.S.A.: Iowa, Illinois, Kansas, Oklahoma, Arkansas, Texas, Louisiana, Michigan, Indiana, Ohio, New Hampshire, New York, Pennsylvania, Virginia, Maryland, New Jersey, Tennessee, N. Carolina, Alabama, Georgia, S. Carolina, Florida. In CAS, California, USNM, Washington etc. Hatch (1961) includes Washington, Idaho and Oregon.

HABITATS. Under bark of various trees including *Castanea*, *Quercus*, *Acer* and *Populus*.

## ***Silvanus unidentatus*** (Olivier)

(Text-fig. 57)

***Ips unidentata*** Olivier, 1790 : 9. Type(s), FRANCE: near Paris [not examined].

***Colydium planum*** Herbst, 1797 : 285. Type(s), GERMANY [not examined]. [Syn. teste Erichson, 1846 : 338.]

***Silvanus unidentatus*** (Olivier) Latreille, 1804 : 158.

***Silvanus gratiosus*** Motschulsky, 1863 : 501. Type(s), CEYLON: near Colombo [not examined]. [Syn. teste Reitter, 1880*b* : 509].

***Silvanus siculus*** Stierlin, 1864 : 147. Type(s), SICILY [not examined]. [Syn. teste Hetschko, 1930 : 63.]

Length 2·10–2·90 mm. Ventral surface rather dull. *Head* broader than long (12·4–12·7 : 10), much narrower than pronotum (ratio of breadth across eyes to that across anterior pronotal angles, 10 : 11·2–12·0); clypeus and frequently frontal triangle, which extends to middle of head, rather sparsely punctured (clypeal punctures mainly setiferous and separated by 3–5 diameter), interspaces moderately shining; rest of head comparatively dull, with dense coarse punctures and finer setiferous punctures on their interspaces, particularly coarse and dense by eyes; eye and temple as in Text-fig. 57, eyes small, comparatively flat about 3 times as long as broad, length no greater than distance from eye to clypeogenal emargination, one quarter to one third length of head, eyes separated dorsally by about four times their length;

temples as long as 1–2 eye-facets. *Pronotum* (Text-fig. 57) a little longer than broad (11 : 10), general appearance rather dull; puncturation dense, disc slightly less densely punctured than sides and often with a longitudinal narrow impunctate mid-line (breadth equivalent to 1–2 punctures); anterior angles as in Text-fig. 57 or slightly less pronounced; disc shallowly depressed on basal third, basal margin ill-defined medially. *Elytra* 2·17–2·24 times as long as broad, interstriae flat, strial punctures about 1·5 times as broad as an eye-facet, fine setiferous punctures on interspaces and interstriae tuberculate but not obviously so at low magnification. *Abdominal sternites* 2–5 with fine setiferous punctures separated by 2–5 diameters. *Legs* in ♀ simple, in ♂ metatrochanter without a distinct prominence; metafemur with a prominent lamellate ridge on apical two-sevenths of ventral side and metatibia with a row of spinules on posterior margin. *Genitalia* ♂, similar to Text-fig. 22 but often with median lobe more strongly tapered to apex.

Number seen: 300.

COMPARATIVE NOTES. The name *unidentatus* has been erroneously applied to many species and non-Palaearctic specimens labelled '*unidentatus*' should be carefully checked. *S. unidentatus* is most closely related and similar to the Nearctic *planatus* and *nitidulus*. For comparison with *planatus* see notes for that species. It may be distinguished from *nitidulus* by pronotal characters as follows: puncturation denser, anterior angles usually moderately developed (in *nitidulus* they are usually poorly developed), sides more sinuate and convergent to base, and posterior angles obvious. In addition to these characters, *unidentatus* is comparatively dull and has a narrower antennal club. From other related African species, *proximus*, *inarmatus* and *mediocris*, it is readily distinguished by the form of its eyes, head and pronotum.

DISTRIBUTION. Palaearctic. FENNOSCANDIA as far north as 67° lat., (Lindroth, 1960); EUROPE (fairly common locally in southern England, scarce in the Midlands and until recently not found further north than Yorkshire; Crowson (1962) found one specimen under bark in Kirkcudbright, Scotland); MEDITERRANEAN; and specimens have been seen from as far east as Burnaul in U.S.S.R., from Manchuria, CHINA, and one specimen in the TM, Budapest was collected in KOREA. It has been introduced to the U.S.A., specimens have been examined from California (CAS, California), Utah (USNM, Washington and CAS, California), Illinois and Pennsylvania (both in CAS, California) and New Jersey (USNM, Washington and CAS, California). There is a series of specimens from Angol, CHILE in USNM, Washington but published records from Grenada (Champion, 1898) have not been confirmed and may refer to *proximus*. Good series of *unidentatus* are held by most European museums.

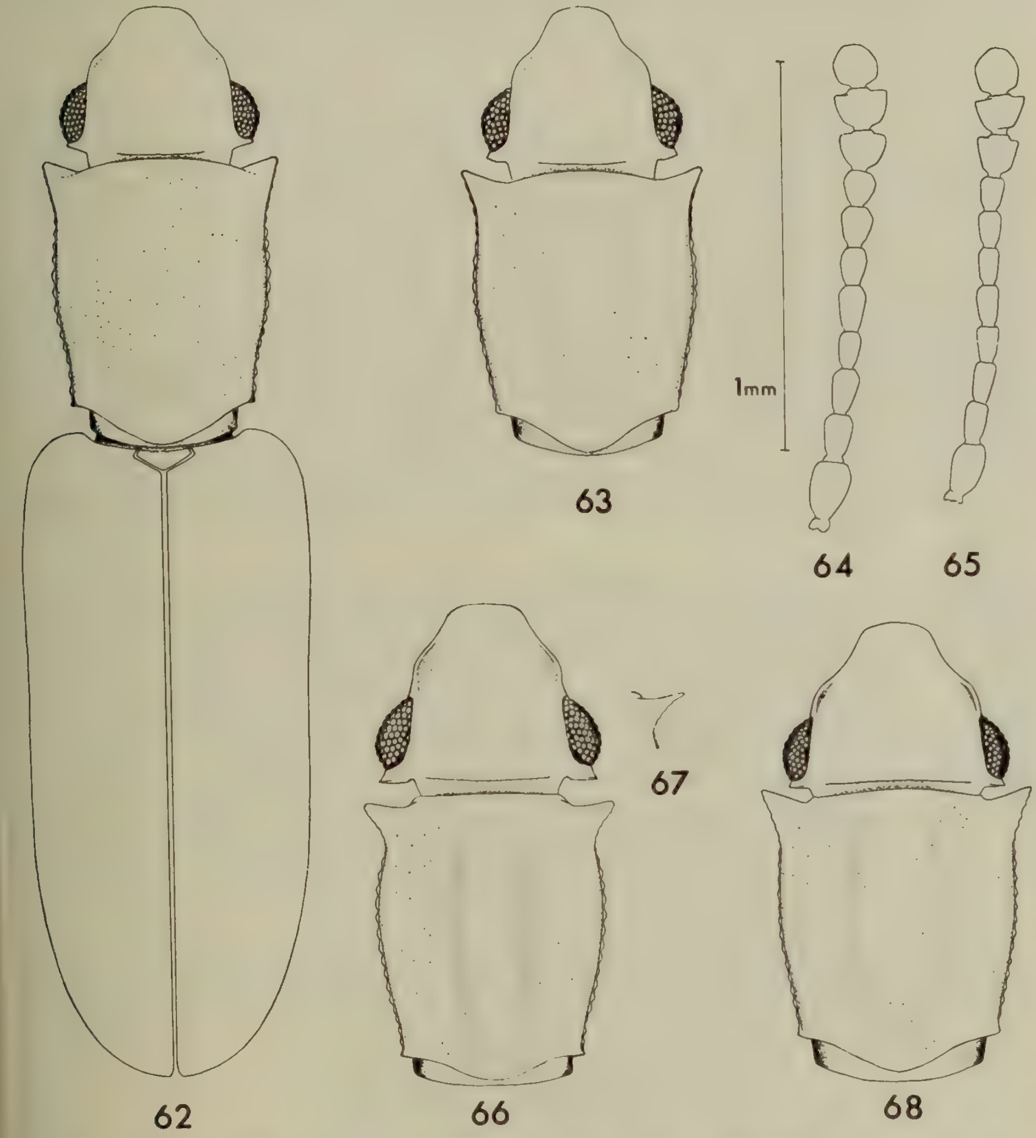
HABITATS. Found under bark of various deciduous trees, e.g. *Fagus*, *Quercus*, *Carpinus* etc.

### ***Silvanus castaneus*** MacLeay

(Text-fig. 62)

*Silvanus castaneus* MacLeay, 1873 [read 1871, published 1873] : 168. Holotype ♀, AUSTRALIA (MacLeay Museum, Sydney) [examined].

Length 2·31–2·97 mm. *Head* broader than long (12·6–13·0 : 10), narrower than pronotum (ratio of breadth across eyes to that across pronotal anterior angles, 10 : 11·6–11·7); frontal triangle with relatively small discrete punctures, interspaces shining; sides of head comparatively dull, puncturation denser than on frontal triangle, not obviously ocellate (frequently the puncturation of the head is partly hidden by the golden decumbent setae); genal margin not obviously raised; eye 2·3–2·5 times as long as broad, separated from clypeogenal emargination by 0·70–0·72 diameter; temple as long as an eye-facet. *Pronotum* (Text-fig. 62) longer than broad (12·7–13·2 : 10), dull with coarse, dense, rather shallow puncturation; anterior



FIGS 62–68. *Silvanus*. 62, *S. castaneus* MacLeay. 63, *S. lateritius* (Broun) head and pronotum. 64, Antenna of *S. bidentatus* (F.). 65, Antenna of *S. muticus* Sharp. 66–67, *S. bidentatus* (F.). 66, Head and pronotum. 67, Variant of anterior angle of pronotum. 68, *S. muticus* Sharp, head and pronotum.

angles with sides more or less straight (Text-fig. 62) may be more or less prominent laterally than illustrated, gradually developed from side of pronotum, very slightly produced anteriorly beyond anterior margin; disc usually with a deep, broad depression, particularly strong towards base, where its derivation from two lateral foveae is often apparent; posterior angles almost right-angles. *Elytra* 2·3 times as long as broad; ratio of breadth across humeri to that across pronotal posterior angles, 13·7–14·5 : 10, rounded to apex as in Text-fig. 62. *Ventral surface* shining, interspaces may be reticulate. *Legs* in ♀ simple, in ♂ metatrochanter with a tubercle towards apex, femur with a lamellate ridge traversing ventral side from basal quarter of posterior margin to mid-line at apical half, tibia with a row of spinules on posterior margin.

Number seen: 100.

I am accepting the specimen in the MacLeay Museum, Sydney with 'Gayndah [ptg.]/Silvanus castaneus, MacL. Gayndah [MS]', a ♀, as the holotype. The original description gives a single measurement for length of the species. There is no other indication of the number of specimens seen by MacLeay.

COMPARATIVE NOTES. *S. castaneus* has been confused with *unidentatus* and *lateritius* (Broun), species from which it may be distinguished by the general facies of head and thorax. In some specimens of *lateritius* the discal depression on the pronotum is almost identical with that of *castaneus* and as this species is often found with *castaneus* in Australia, the following comparative characters should prove useful: in *castaneus* (1) puncturation of the frontal triangle different from that at the sides of the head; (2) anterior angles of pronotum with more or less straight sides, less acute; (3) prosternal process without a distinct depression towards base and not obviously channelled between coxae; and (4) elytra slightly less acuminate to apex.

DISTRIBUTION. Oriental and Australian. SINGAPORE: Seletar; (imported from SARAWAK? to Britain); AUSTRALIA: Western Australia – Geraldton, Sir Graham Moore Is, National Park Upper Ord River and Perth; Northern Territory – Damma Is, Groote Eylandt, Melville Is and Port Darwin; Queensland – Brisbane, Cairns, Cardstone, Coen River, Cootha Mt., Dalby, Gayndah (type-locality), Glasshouse Mts, Goodna, Ingham, Kuranda, Magnetic Is, Rockhampton and Tambourine Mts; New South Wales – Curragong, Gundagai, Moree, Narrabri and Sydney; Victoria – Dandenong Ranges, Hamilton, Inglewood, Mallee district and Oyen; TASMANIA. In AM, Sydney; ANIC, Canberra; BMNH, London; Dr Brooks collection, Cairns; NMV, Victoria; PICL, Slough; QM, Queensland; SAM, Adelaide; TM, Budapest.

HABITATS. Found under bark and at light. Occasionally imported to Britain on illipe nuts from Indonesia and Singapore, one record on flour bags which were on top of a redwood consignment and another on a bag of rice, both from Australia.

## ***Silvanus bidentatus*** (Fabricius)

(Text-figs 64, 66, 67)

*Dermestes 2 dentatus* Fabricius, 1792*a* : 233. Type(s), GERMANY (2 specimens in Kiel Fabrician collection, Zoological Museum, Copenhagen (Zimsen, 1964)) [not examined].

*Colydium sulcatum* Fabricius, 1792*b* : 555. Type(s), GERMANY (1 specimen in Kiel Fabrician

collection, Zoological Museum Copenhagen (Zimsen, 1964)) [not examined]. [Syn. teste Erichson, 1846 : 338.]
*Silvanus bidentatus* (Fabricius) Sturm, 1826 : 196.
*Silvanus affinis* Reitter, 1876 : 58. LECTOTYPE ♂ (here designated, see below), JAPAN (BMNH, London) [examined]. **Syn. n.**
*Silvanus bidentatus* var. *affinis* Reitter; Reitter, 1880 : 509.

Length 2·54–3·49 mm. Dull. *Head* (Text-fig. 66) broader than long (11·8–12·3 : 10), narrower across eyes than pronotum across anterior angles (10 : 11·2–11·4); densely punctured with coarse punctures (as large or larger than eye-facets) and finer setiferous punctures, which may appear ocellate (similar to *lewisi*, Text-figs 1 and 5); clypeal region moderately shining, rest of head dull; genal margin raised forming a low triangular prominence; antennae as in Text-fig. 64; eye moderately prominent 2–2·5 times as long as broad, separated from clypeogenal emargination by 0·65–0·74 times their length; temple as long as two eye-facets or slightly shorter (eye diameter to temple ratio, 4·5–7·4 : 1·0). *Pronotum* (Text-fig. 66) longer than broad (12·9–13·3 : 10), puncturation as on vertex of head; anterior angles rather abruptly developed from side of pronotum, strongly produced laterally, sometimes very fine (Text-fig. 67), not produced anteriorly beyond anterior margin; disc with deep lateral longitudinal foveae, well-defined from base to apex; posterior margin ill-defined medially; disc of *metasternum* and *abdominal sternites* 1 and 2 depressed (depression extending from anterior third of metasternum to posterior half of sternite 2, deepest in ♂). *Elytra* 2·1–2·2 times as long as broad, much broader across humeri than pronotum across posterior angles (15·4–16·2 : 10); strial punctures deep; interspaces and interstriae raised, approximately equal to breadth of strial punctures and with strongly tuberculate setiferous punctures (obviously tuberculate at low magnification). *Ventral surface* dull, tuberculate and interspaces reticulate throughout. *Legs* in ♀ simple, in ♂ metatrochanter with a small but prominent spine and metafemur bearing a moderate ridge on basal third of ventral side (without spinules on tibiae).

Number seen: 100+.

Lectotype of *affinis* Reitter, present designation, ♂, length 2·88 mm, 'Type H.T. [ptg., circular red-bordered label]/Matsu rare [green label]/Japan G. Lewis 1910 – 320/Silvanus affinis in Japan [MS]'. Paralectotype, on the same card as the lectotype (left hand specimen), ♀, length 3·27 mm.

COMPARATIVE NOTES. This species is extremely closely related and similar to *muticus*, see comparative notes for the latter. The species *lateritius* of Broun was erroneously synonymized with *bidentatus*, although differences between these species are obvious. The deep well-defined lateral foveae distinguish *bidentatus* from all species except *muticus*.

DISTRIBUTION. Palearctic and introduced elsewhere. FENNOSCANDIA, most northern record c. 66° N (Lindroth, 1960). EUROPE (rare in Britain, where it has been recorded from Renfrewshire, Northumberland, Cheshire, Berkshire, Surrey, Essex and Kent (Allen, 1956); Allen suggests that there may have been a recent extension of its range in Britain and that originally it may have been introduced). It is recorded as rare in European RUSSIA (Kryzhanovskij, 1965). It occurs in JAPAN, from where it was first described as a new species, *Silvanus affinis*, by Reitter. *S. bidentatus* has been introduced to CANADA and the U.S.A., specimens in USNM, Washington and CAS, California were collected in the following states: British Columbia, California, Colorado, Wisconsin, Texas, New Hampshire, New York, Massachusetts, Pennsylvania and New Jersey. Other localities represented by single specimens in the BMNH, London are ST PAUL ROCKS (Mid Atlantic), HAWAIIAN IS, INDIA and in the CAS, California, THAILAND. Examples of this species may be found in most European Museums.

HABITATS. Although this species is said to be found beneath the bark of pine (*Pinus*) in Europe, it has been discovered under bark of *Fagus* and *Quercus* in Britain. Recently, living *S. bidentatus* were found on dunnage in a ship carrying flour and wheat from Canada to England.

### ***Silvanus muticus*** Sharp

(Text-figs 65, 68)

*Silvanus muticus* Sharp, 1899 : 560. Holotype sex indet., GUATEMALA (BMNH, London) [examined].

Length 2·52–3·20 mm. General facies and puncturation (including elytral striation) similar to *bidentatus*. *Head* broader than long (11·7–13·3 : 10), narrower across eyes than pronotum across anterior angles (10 : 10·8–11·9); antennae as in Text-fig. 65; eyes moderately prominent, 2–2·5 times as long as broad, separated from clypeogenal emargination by 0·62–0·83 times their length; temple as long as 0·5–1·0 times eye-facet (eye diameter to temple ratio, 10·5–17·6 : 1·0). *Pronotum* (Text-fig. 68) longer than broad (12·3–13·0 : 10); anterior angles gradually developed from side of pronotum, slightly produced anteriorly beyond anterior margin; discal foveae similar to those of *bidentatus* but usually shallower; *metasternal disc* shallowly depressed on posterior two-thirds or in ♂ on whole of disc, discs of *abdominal sternites* 1 and 2 often shallowly depressed, particularly in ♂. *Elytra* 2·0–2·1 times as long as broad, broader across humeri than pronotum across posterior angles (15·0–15·5 : 10). *Legs* in ♀ simple; in ♂ metatrochanter with a low ridge and usually an ill-defined spine, metafemur with a prominent ridge on basal third of ventral side.

Number seen: 350.

COMPARATIVE NOTES. This American species is extremely close to the Palaearctic *bidentatus* and although recognized as distinct by Sharp (1899) (type-locality Guatemala), it continued to stand under '*bidentatus*' in American (and other) collections. *S. bidentatus* appears to be comparatively rare in the U.S.A. It may be distinguished from *bidentatus* as follows: antennae less robust, segments 3–8 slightly more elongate (see Text-figs 64, 65), temples narrower; anterior angles of pronotum gradually developed (not abruptly developed as in *bidentatus*), foveae of thorax usually shallower; in ♂ a more prominent ridge on metafemur and a much less prominent tooth (if present) on metatrochanter.

DISTRIBUTION. Nearctic and Neotropical. CANADA: Montreal (1 ex.). U.S.A.: California, Wisconsin, Iowa, Illinois, Kansas, Arkansas, Texas, Louisiana, Michigan, Ohio, New Hampshire, New York, Massachusetts, Pennsylvania, W. Virginia, Virginia, Maryland, New Jersey, Tennessee, N. Carolina, Alabama, Georgia, S. Carolina, Florida. GUATEMALA (type-locality – only holotype seen from Guatemala). In CAS, California, and USNM, Washington.

HABITATS. Found associated with various trees, usually beneath bark (records include *Pinus*, *Acer*, *Quercus*, *Castanea*, and *Juniperus*) and at light.

## ***Silvanus robustus* sp. n.**

(Text-figs 23, 75–77)

Length 2·53–2·98 mm. Dorsal puncturation similar to *difficilis*. *Head* a little broader than long (10·5–11·2 : 10), narrower across eyes than pronotum across anterior angles (10 : 10·7–11·6); genal margin moderately to strongly raised eyes separated ventrally by 2–2·4 breadths (not as large as usual for *difficilis*); temples as long as 1·5–2 eye-facets, ratio of temple-length to eye-length, 1 : 7·4–8·2; antennal club segments rather quadrate, club appearing elongate (Text-fig. 77). *Pronotum* (Text-fig. 75) usually moderately gibbous, longer than broad (13·6–13·9 : 10); sides not distinctly sinuate before posterior angles; disc with a shallow to moderate depression towards base; *prosternum* with prominent shining tubercles. *Elytra* 2·1–2·2 times as long as broad, similar to *lewisi*, margins obviously explanate. *Legs* in ♀ simple; in male, metatrochanter with a prominent tubercle, metafemur with a distinct ridge on anterior margin, metatibia with a row of spinules on posterior margin (Text-fig. 76). *Genitalia* ♂, median lobe and paramere (Text-fig. 23).

Holotype ♂, length 2·83 mm, MALAYA: Johore, Layang, light trap in oil palm estate, 30.v.69 (*D. H. Murphy*) (BMNH, London).

Paratypes (8). 1 ex., MALAYA: Johore, S. Kahang estate, light trap (*J. R. Pippet*) (PICL, Slough); 2 ex., SINGAPORE: 1898 (*Biro*) (TM, Budapest); 1 ex., JAVA: Buitenzorg (*E. Csiki*) (TM, Budapest); 1 ex., Soekaboemi (*Mrs Walsh*) (BMNH, London); 1 ex., SARAWAK: Sibu, from dried illipe kernels, 1968 (*M. Connell*) (BMNH, London); 1 ex., Sibu, 1968 (*M. Connell*) (PICL, Slough); 1 ex., PHILIPPINES: Basilan (*F. Nevermann*) (USNM, Washington).

COMPARATIVE NOTES. This species is closely related to *difficilis* and certain specimens of *robustus* look very similar to it, e.g. those from Singapore (TM, Budapest). Most specimens are easily distinguished by the gibbous pronotum but in some this is poorly developed. The lack of distinct lateral and apical depressions on the pronotal disc and the more elongate antennal club may be used to distinguish *robustus* from *difficilis*. Additional characters are provided by the eyes, which are usually smaller in *robustus*, the side of the pronotum, which is obviously sinuate before the posterior angles in *difficilis* and size, *robustus* being the larger species.

DISTRIBUTION. Oriental; Malaya, Singapore, Java, Sarawak and Philippines.

HABITATS. Two of the types were collected at light and one on illipe nuts.

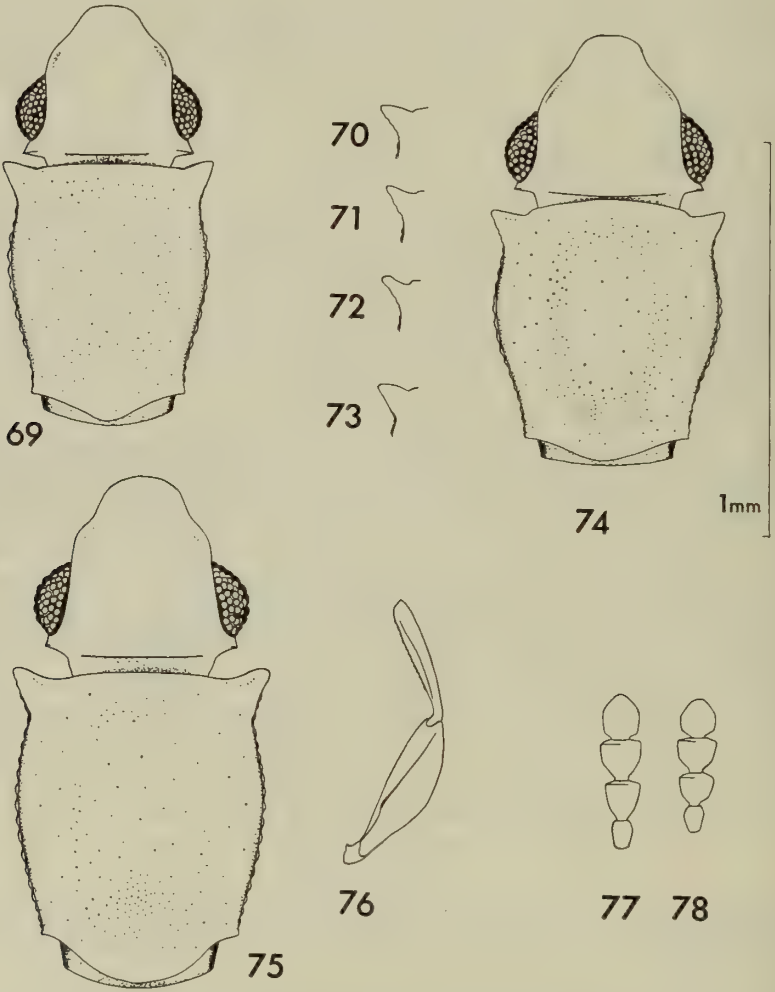
## ***Silvanus lateritius* (Broun) sp. rev.**

(Text-fig. 63)

*Cryptamorpha lateritia* Broun, 1880 : 222. LECTOTYPE (here designated, see below), NEW ZEALAND (BMNH, London) [examined]. [Regarded as synonymous with *Silvanus bidentatus* (F.) by Walker 1912 : 18.]

Length 2·47–2·84 mm. *Head* broader than long (12·0–12·6 : 10), narrower across eyes than pronotum across anterior angles (10 : 11·7); head rather dull, everywhere densely and coarsely punctured, setiferous punctures appearing ocellate (similar to *lewisi*, Text-fig. 1); genal margin slightly raised; eye 2·2–2·5 times as long as broad, separated from clypeogenal emargination by 0·68–0·74 diameter, separated ventrally by 2·3–3·7 breadths; temple longer than an eye-facet (1·0–1·5 eye-facet diameters). *Pronotum* (Text-fig. 63) longer than broad (12·9–13·5 : 10), puncturation as on head; anterior angles moderately acute as in Text-fig. 63, sometimes more prominent and narrower than illustrated, slightly produced anteriorly beyond apex of anterior margin; disc moderately to strongly depressed, bearing weak lateral foveae which fuse towards base; posterior angles obtuse. *Elytra* 2·2–2·3 times as long as broad; ratio of breadth across humeri to that across posterior angles of pronotum, 14·8–16·1 : 10, margins very narrow for basal two-thirds, not explanate, slightly broader towards apex moderately acuminate to apex. *Sternites* rather dull, puncturation of prosternum coarse, dense and tuberculate towards sides. Metasternal disc slightly depressed. Disc of abdominal sternites 1 and 2 depressed in ♂, more or less flat in ♀. *Legs* with secondary sexual characters as in *castaneus*.

Number seen: 60.



FIGS 69–78. *Silvanus*. 69–74, *S. difficilis* sp. n. 69, New Guinea form, head and pronotum. 70–73, Variants of anterior angle of pronotum – specimens from: 70, Singapore; 71, New Guinea; 72, Java; 73, Vietnam; 74, Normal form, head and pronotum, specimen from Sarawak. 75–77, *S. robustus* sp. n. 75, Head and pronotum. 76, Hind leg of ♂ (less tarsus). 77, Antennal segments 8–11. 78, *S. difficilis* sp. n., same.

Broun (1880) in his description states 'I found one specimen mutilated under bark of Leptospermum at Tairua, some years ago, and three others recently near Whangarei Heads, under Rimu bark.' In the BMNH, London there are two specimens labelled 'Tairua [ptg.]' and one of these has its right anterior pronotal angle broken. I am accepting this specimen as the lectotype. The authenticity of the labelling of the other specimen is questionable. The material from Whangarei is not in the BMNH, London nor in the collection of the DSIR, Auckland.

Lectotype, present designation, sex indet., length 2·93 mm, with '390/Tairua/New Zealand Broun Coll. Brit Mus 1922–482'.

COMPARATIVE NOTES. This species is similar to *castaneus* (see comparative notes for *castaneus*), *difficilis*, *robustus*, the American *muticus* and was placed in synonymy with *bidentatus*. It can be distinguished from *robustus* by the form of its antennal club, the narrow elytral margins and its eyes, which are usually smaller. Similarly the smaller eyes of *lateritius* distinguish it from *difficilis;* also the form of the pronotum is diagnostic. *S. muticus* has broader elytra (1 : 2·0–2·1) which are more strongly tapered to their apices than in *lateritius*, etc. The pronotum with gradually developed anterior angles and weak lateral foveae is quite different from that of *bidentatus* and the head-form with shorter temples is also distinct.

DISTRIBUTION. Australian (including New Zealand) and probably introduced to South Africa, Madeira and Hawaiian Is. AUSTRALIA: Western Australia – National Park Upper Ord River; Queensland – Brisbane, Cairns, Crystal Creek, Southport and Tambourine Mts; New South Wales – Clarence Town, Cumberland, Gundagai, Hornsby, Mundarlo, Sydney, Upper Willi'ms R' and Wahroonga; Victoria – Beaconsfield, Buchan, Dividing Range, Emerald, Inglewood, Noble Park, Orbost and Warburton; South Australia – Adelaide and Mt Lofty Range; TASMANIA: Franklin; NEW ZEALAND (type-locality): Auckland, Mt Albert, Owairaka, Waitakere Ranges (in coll., of DSIR, Auckland) and Glenhope (in BMNH, London); HAWAIIAN IS (2 ex., CAS, California), Cape Province, Ceres (1 ex., BMNH, London); MADEIRA (5 ex., BMNH, London, dated 1899). Australian specimens in AM, Sydney; AMC, Canberra; NMV, Victoria; SAM, Adelaide; PICL, Slough; QM, Queensland.

HABITATS. Found under the bark of *Eucalyptus*, 'under bark' and at light. Occasionally imported to Britain from Australia on sultanas etc., and one specimen found alive on cartons of canned peaches from Cape Town.

## *Silvanus difficilis* sp. n.

(Text-figs 18, 69–74, 78)

Length 2·17–2·64 mm. Dull, brown to yellow-brown, represented in New Guinea by the normal form and by one which has long temples, the 'New Guinea form'. *Head* broader than long (10·8–11·9 : 10), narrower across eyes than pronotum across anterior angles (10 : 10·6–11·6); puncturation similar to *lewisi* but punctures on frontal triangle often appearing rather ocellate; eyes usually large but size variable, hence separated ventrally by 1·1–2·1 breadths and equal to one half or less of head-length; normal form: temples as long as 1–1·5 eye-facets, ratio of temple-length to eye-length 1 : 7·0–10·5, 'New Guinea form': temples as long as 2–2·5 eye-facets, ratio of temple-length to eye-length 1 : 4·3–6·5 (Text-fig. 69); antennae broader than in *lewisi*, club as in Text-fig. 78. *Pronotum* longer than broad (12·4–13·4 : 10) more elongate than in *lewisi;* sides distinctly convergent to base as in Text-figs 69 and 74 or more so, obviously sinuate before posterior angles; puncturation coarse and dense, similar to that on head; anterior angles usually broader than in *lewisi* and not as strongly tapered to apex but variable (Text-figs 69–74); disc feebly depressed towards apex and at sides (sometimes with these depressions ill-defined) more strongly depressed at base; posterior angles greater than right-angles; *prosternum* with surface tuberculate and becoming rugose towards sides, surface of *metasternum* and 1st *abdominal sternite* similar but tubercles slightly smaller. *Elytra* 2·0–2·1 times as long as broad, similar to *lewisi*. *Legs* in ♀ simple, in ♂ metatrochanter with a low ridge forming a weak protuberance; metafemur with a ridge from basal quarter to half of anterior margin; metatibia with a row of spinules along posterior margin. *Genitalia* ♂, median lobe and paramere, Text-fig. 18.

Holotype ♂, length 2·34 mm, MALAYA: Keruing, 30.ii.1933 (*R. C. Fisher*) (BMNH, London).

Paratypes (109 normal form and 34 New Guinea form). Normal form. 1 ex., INDIA: Cinchona, Anamalai Hills, v. 1968 (ZM, Berlin); 1 ex., W. Almora Divn, Kumaun UP., xii. 1916 (*H. G. C[hampion]*); 1 ex., Kheri Forest, U.P., i. 1916 (*H. G. C[hampion]*); 1 ex., Kanara (*Andrews*), this and the previous 2 ex. in BMNH, London; 1 ex., Malabar coast, Mahè, 1901 (*Maindron*) (MNHN, Paris); 2 ex., Cochin, found on damp wood cases, M.A.F. Inf. Control H.Q. 266/54; 1 ex., CEYLON: on bags of desiccated coconut loaded Colombo, LIV 25/68; 2 ex., on Colombo tea, shed Tilbury docks, England, 15.iii.1965 (7995) 9824, in PICL; 1 ex., VIETNAM (NORTH): Hanoi, at light, 25.x.1963 (*T. Pocs*) (TM, Budapest); 1 ex., TAIWAN: Taihorin, 1911 (*H. Sauter*) (MNHN, Paris); 1 ex., MALAYA with same data as holotype, also in BMNH, London; 1 ex., Johore, S. Kahang Estate, ii. 1962 (*D. H. Murphy*) (PICL, Slough); 1 ex., Malaya (?) found in debris in hold of vessel on Malayan and Indonesian run, Malayan copra and palm kernels carried in holds, M.A.F. Inf. Control H.Q. 163/54 (PICL, Slough); 3 ex., Penang, xi. 1913 (*G. E. Bryant*) (BMNH, London); 1 ex., from SINGAPORE, imported on sago flour, M.A.F. Inf. Control H.Q. 119/55 (PICL, Slough); 1 ex., SUMATRA: Abjeh [?] (*L. G. E. Kalshoven*); 1 ex., Indargoon (*Verzon*) (MNHN, Paris); 4 ex., JAVA: Papandajan, 10.iv.1909 (*G. E. Bryant*) (BMNH, London); 6 ex., Batavia [Jakarta], 1898 (*Biro*) (TM, Budapest); 1 ex., Soekaboemi, 1916 (*Mrs Walsh*); 1 ex., Trisk [?], iii. 1930 (*L. Kalshoven*); 1 ex., Bogor, 29–30.iv. 1954 (*A. H. G. Alston*); 2 ex., CHRISTMAS IS, (Indian Ocean): i.iv.1933; 1 ex., 1939 (*Dr C. A. Gibson-Hill*), this and the previous 5 ex. in BMNH, London; 1 ex., SARAWAK: Semongok, 1st Div., in house, 29.ii.1968 (*M. Connell*) (PICL, Slough); 1 ex., Quop, 9.iii.1914 (*G. E. Bryant*); 3 ex., Mt. Matang, xii. 1913 (*G. E. Bryant*); 2 ex., BORNEO: Upper Kinabatang R., ii. 1950 (*J. K. Cox*), these and the previous 4 ex. in BMNH, London; 1 ex., PHILIPPINES: Basilan, x. 1930; 1 ex., Luzon, Los Banos, x. 1930; 1 ex., Mindanao, Kolambugan, x. 1930, this and the previous 2 ex. in USNM, Washington; 1 ex., MOLUCCAS: Makian (*Wallace*) (BMNH, London); 1 ex., NEW GUINEA (*Wallace*) (BMNH, London); 2 ex., New Guinea (*Biro*) (TM, Budapest); 15 ex., Hollandia, 20.x.1944 (*T. Aarons*) (CAS, California); 1 ex., Finschhafen, iv. 1944 (*E. S. Ross*) (CAS, California); 9 ex., Waing, ca 18 ml. 'of Lae', 13–14.iv.1965

(*Dr J. Balogh and Dr J. J. Szent-Ivany*) (TM, Budapest); 2 ex., Papua, Kokoda, 1,200′, vii–viii. 1933 (*L. E. Cheesman*); 3 ex., Cyclops Mts, Sabron, 930′, v. 1936 (*L. E. Cheesman*); 3 ex., Cyclops Mts, Sabron camp 2, 2,200′, 15.v.1936 (*L. E. Cheesman*); 1 ex., Cyclops Mts, Sabron camp 1, 1,200′, 15.v.1936 (*L. E. Cheesman*); 6 ex., Waigen camp 1, Mt. Nok, 2,500′, v. 1938 (*L. E. Cheesman*); 1 ex., Waigen, Mt. Nok camp 2 (Buffelhorn), vi. 1938 (*L. E. Cheesman*), this and the previous 15 ex. in the BMNH, London; 1 ex., Boana Mission, Huon Pen, 900 m, 4.ix.1956 (*E. J. Ford*) (BPBM, Honolulu); 3 ex., I. DESLACS: 1901 (*Biro*) [off N. coast of NEW BRITAIN, part of VITU group] (TM, Budapest): 1 ex., SOLOMON IS: San Christoval, N.E. Wainoni, Huni River estuary, 9–12.viii.1965; 1 ex., Guadalcanal, Ilu Bush, 16.iii.1962 (*P. J. M. Greenslade*); 1 ex., Guadalcanal, Kukum, 9.xii.1965–13.i.1966 (*P. Greenslade*); 1 ex., SAMOAN IS.: Upolu, Malololelei, 2000′, vi. 1924 (*P. A. Buxton & G. H. Hopkins*); 1 ex., Samoa, 1920 (*Dr H. Swale*), this and the previous 5 ex. in the BMNH, London; AUSTRALIA: 4 ex., Cairns district (*A. M. Lea*) (SAM, Adelaide); 2 ex., COSTA RICA: Hamburgfarm, Reventazon, Ebene Limon, ausgesägtern Holz, 1.xi.1934 (*F. Nevermann*); 1 ex., S. Jose, La Caja, v. 1932 (*H. Schmidt*), both in USNM, Washington; 1 ex.,? WEST AFRICA, on cargo matting on ship carrying W. African groundnut cake, logs etc., M.A.F. Inf. Control H.Q. 175/54 (PICL, Slough).

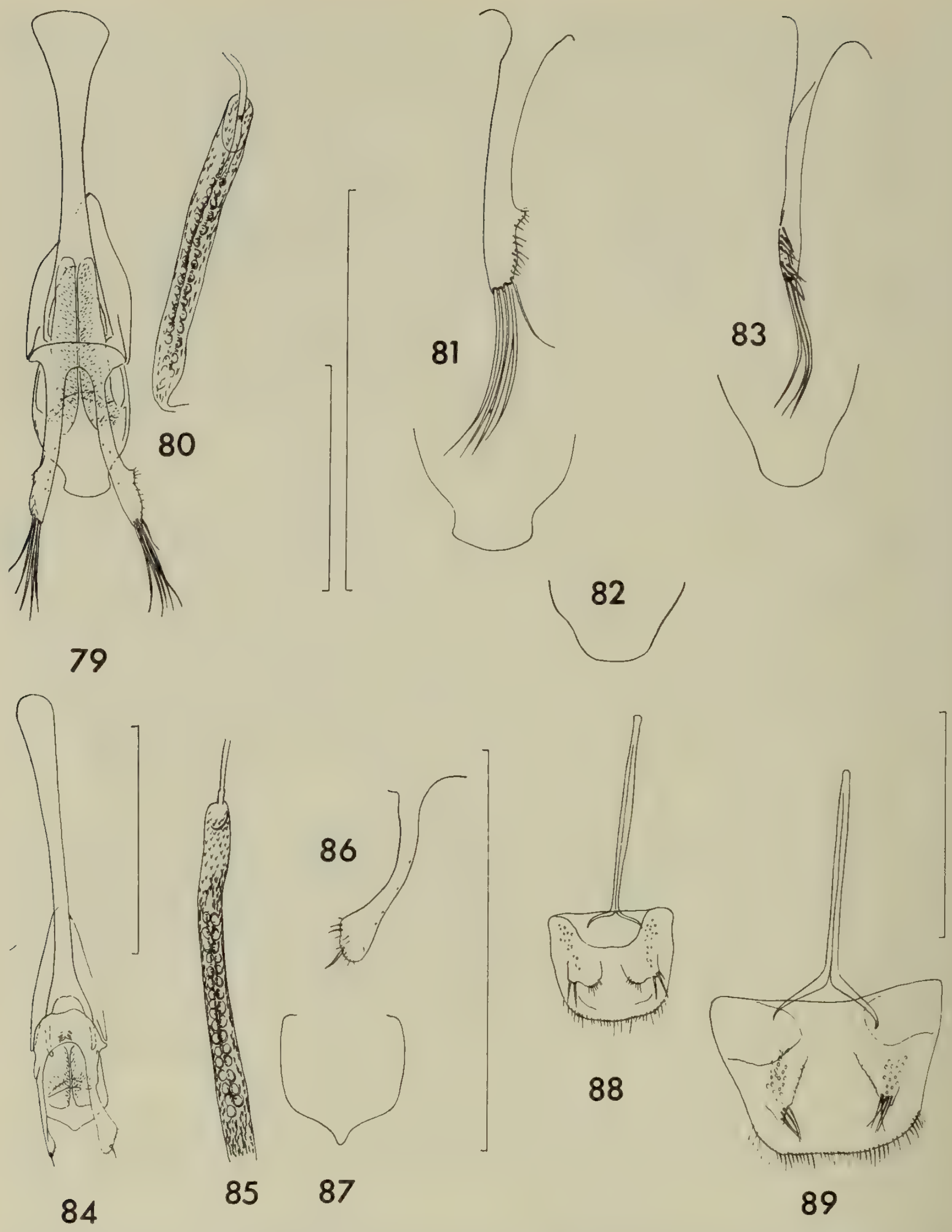
New Guinea form. 19 ex., NEW GUINEA: Waigen Camp I, Mt. Nok, 2500′, v. 1938 (*L. E. Cheeseman*); 3 ex., Waigen Mt., Nok Camp 2 (Buffelhorn) vi. 1938 (*L. E. Cheesman*); 8 ex., Waigen Camp, Nok, 2500′, iv. 1938 (*L. E. Cheesman*), these and the previous 22 specimens in BMNH, London; 1 ex., NEW IRELAND: 12 km up Kait R., 240 m, 'Camp Bishop', 8.vii.1956 (*E. J. Ford*) (BPBM, Honolulu); 2 ex., AUSTRALIA: Cairns, Queensland, 26.i.38 (*Dr H. Brooks* Collection); 1 ex., Cairns District (*A. M. Lea*) (SAM, Adelaide).

COMPARATIVE NOTES. This extremely variable species contains some individuals which are similar to *robustus* others to *productus* and the large eyes may lead to confusion with *lewisi*. It may be distinguished from the latter species and *rossi* by the shape of the pronotum and the usually deeper lateral and apical depressions on its disc. The slightly less even and less recumbent setation and the broader temples also distinguish it from *lewisi*. See comparative notes regarding *robustus* and *productus*.

Grouvelle sometimes confused this species with *lewisi* and his *Silvanoprus* (*Silvanus* of Grouvelle) *birmanicus*.

DISTRIBUTION. Oriental, including N. Queensland of Australia and apparently introduced to Costa Rica; see data of type-series. The Australian specimens may have been imported on timber.

HABITATS. This species has been collected at light (Vietnam) on *Shorea robusta* (India) and it is found sporadically on commodities imported to Britain from the Oriental region and possibly on one occasion from Africa.



FIGS 79–89. 79–83, *Pensus* gen. n. 79–82, *P. gilae* (Casey). 79, Male genitalia. 80, Internal sac. 81, Paramere and apex of median lobe of 79, 82 apex of median lobe of another specimen. 83, *P. guatemalenus* (Sharp) paramere and apex of median lobe. 84–88, *Calpus bacchi* gen. et sp. n. 84, Male genitalia. 85, Internal sac. 86, Paramere. 87, Median lobe. 88, Sternites 8 and 9. 89, *Pensus gilae* (Casey) same. Scale lines = 0·4 mm.

## ***PENSUS* gen. n.**

Type-species: *Silvanus gilae* Casey.
Number of species: 2.

Length 2·76–3·77. General facies of head and pronotum characteristic (Text-figs 90–94). This genus differs from *Silvanus* as follows: *Head* with ocellate setiferous punctures. *Antennae* more robust than usual for *Silvanus*, segment 6 obviously smaller than 7, which is about as broad as 9, segment 8 transverse and much shorter than segments 7 and 9, more obviously differentiated than in *Silvanus*, 9 and 10 forming a loose club with apical segment. *Eyes* rather small in comparison with most *Silvanus;* temples not longer than 1·5 eye-facets (in known species). *Thorax* with pronotum slightly to moderately elongate, with shallow depressions towards apex and/or base of disc; anterior and posterior angles well developed. *Legs* with tarsal segments slightly broader than in *Silvanus*, secondary sexual characters exhibited by ♂ as follows: metatrochanter with spine, metafemur with a long ridge, metatibia with a conspicuous row of spines on *each* margin, all tibiae more curved than in ♀. *Elytra* obviously explanate at sides in *gilae;* epipleura with a high vertical inner rim, broad, gradually tapered to near apex, then angled to it. *Genitalia* ♂, parameres with 3–5 very long apical setae and finer short setae towards apex (Text-figs 81, 83), not forked at apex; median lobe with a broad apex; ♂ abdominal sternites 8 and 9 as in Text-fig. 89.

DISTRIBUTION. Nearctic and Neotropical.

### KEY TO THE SPECIES OF *PENSUS*

1 Head broader (breadth : length, 11·8–13·4 : 10); eye small with temple as long as 1–1·5 eye-facets; head and pronotum as in Text-figs 90, 91. Nearctic **gilae** (Casey) (p. 77)

– Head narrower (breadth : length, 11·4–11·6 : 10); eyes larger with temples virtually absent; head and pronotum as in Text-figs 93, 94. Neotropical **guatemalenus** (Sharp) (p. 79)

## ***Pensus gilae* (Casey) comb. n.**

(Text-figs 79–82, 89, 90–92)

*Silvanus gilae* Casey, 1884 : 72. LECTOTYPE ♀ (here designated, see below), ARIZONA (USNM, Washington) [examined].

Length 2·76–3·77 mm. A large robust species with small eyes. *Head* broader than long (11·8–13·4 : 10), narrower across eyes than pronotum across anterior angles (10 : 12·1); clypeus and frontal triangle with rather dense ocellate setiferous puncturation, punctures separated by 1–2 diameters, sides of head with punctures less dense, interspaces granulate and with small irregular punctures; genae not produced; eyes small, 2·6–2·9 times as long as broad (Text-fig. 90); temple as long as 1–1·5 eye-facets. *Pronotum* a little longer than broad (10·8–11·4 : 10); puncturation as on head; sides rounded (Text-fig. 90) or comparatively straight (Text-fig. 91); disc slightly depressed towards base; *pro- meso-* and *metathorax* with coarse deep puncturation; interspaces with strong reticulation. *Elytra* 2·1–2·3 times as long as broad, setal punctures tuberculate, giving a rather granulate appearance; sides distinctly explanate from humeri to apex, explanation as broad as a stria.

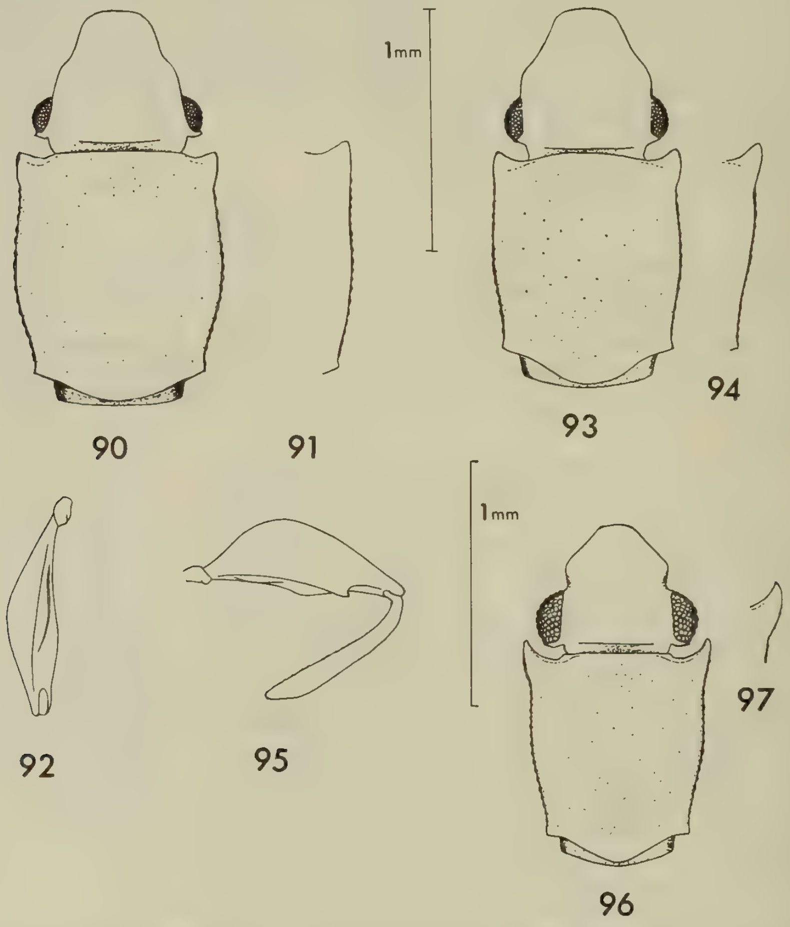
*Abdominal sternites* with shallow ill-defined punctures (irregular depressed areas) interspaces strongly reticulate. *Legs* in ♀ simple; in ♂ metatrochanter with a spine and metafemur with a prominent ridge which curves across from posterior to anterior margin (Text-fig. 92), all tibiae distinctly curved (in ♀ comparatively straight), metatibia with a conspicuous row of spinules along each margin. *Genitalia* ♂, Text-figs 79–82.

Number seen: 20.

Lectotype, present designation, ♀, length 3·32 mm, with 'Ari/CASEY bequest 1925/TYPE USNM 49142 [red label] gilae Ca'.

COMPARATIVE NOTES. Very closely related to *guatemalenus* from C. America but *gilae* has a less elongate head with smaller eyes, a pronotum usually of different shape, but both species tend towards the same form, and a broader elytral explanation.

DISTRIBUTION. Nearctic. U.S.A.: Colorado, Ouray and 'Col[orado]' in USNM, Washington; Arizona, S. Rita Mts (USNM, Washington and CAS, California), Huachuca Mts, Sta Cataline Mts, Graham Mts; New Mexico, Cloudcroft (all in CAS, California). MEXICO: N. Sonora (specimen mentioned in Sharp (1899)) (BMNH, London), 15 ml. S. of El Guarda, 13 ml. W of Milpillas Zacatecas, SE slope of Mt Colima (CAS, California).



FIGS 90–97. 90–94, *Pensus* gen. n. 90–92, *P. gilae* (Casey). 90, Head and pronotum. 91, Variant of side of pronotum. 92, Metatrochanter and femur of ♂. 93–94, *P. guatemalenus* (Sharp). 93, Head and pronotum. 94, Variant of side of pronotum. 95–97, *Calpus bacchi* gen. et sp. n. 95, Hind leg of ♂ (less tarsi). 96, Head and pronotum. 97, Variant of anterior angle of pronotum.

## ***Pensus guatemalenus*** (Sharp) **comb. n.**

(Text-figs 83, 93, 94)

*Silvanus guatemalenus* Sharp, 1899 : 560. LECTOTYPE ♀ (here designated, see below), GUATEMALA (BMNH, London) [examined].

Length 3·09–3·64 mm. Similar to *gilae* in general facies, secondary sexual characters and puncturation. *Head* a little broader than long (11·4–11·6 : 10), narrower across eyes than pronotum across anterior angles (10 : 11·3–11·4); genae moderately produced; eyes prominent 2·4–2·8 times as long as broad; temples virtually absent (Text-fig. 93). *Pronotum* longer than broad (11·8–12·2 : 10); anterior angles well developed (Text-fig. 93) and may be strongly produced (Text-fig. 94); disc slightly depressed near apex, more obviously towards base. *Elytra* 2·1–2·2 times as long as broad; explanation at sides less than breadth of a stria (not as obvious as in *gilae*). *Genitalia* ♂, paramere and median lobe, Text-fig. 83.
Number seen: 12.

There are two syntypes on the same card mount.

Lectotype, present designation, ♀, length 3·48 mm, with 'Silvanus guatemalenus types D.S. Capetilla [Sharp's MS on card mount]/[circular red-bordered 'Type' label.]/Capetillo, Guatemala G.C. Champion/B.C.A. Col. 11 (1) Silvanus' left-hand specimen on card. Paralectotype ♀, length 3·79 mm, right-hand specimen on card.

COMPARATIVE NOTES. See *gilae*.

DISTRIBUTION. Neotropical; Central America. GUATEMALA: near the city, Capetillo, Cerro Zunil, San Gerónimo (Sharp, 1899) (BMNH, London); COSTA RICA (♂ and ♀) (USNM, Washington).

HABITATS. The specimens from Costa Rica were collected under the bark of *Quercus guatemalensis*.

## ***CALPUS* gen. n.**

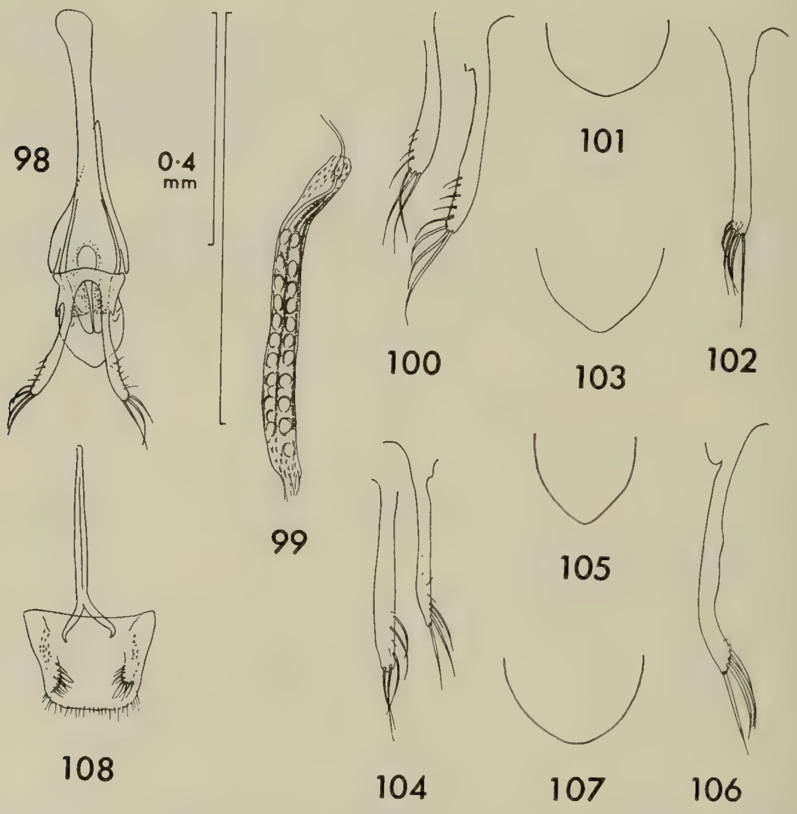
Type-species: *Calpus bacchi* sp. n.
Number of species: 1.

This genus is erected to receive a species from New Guinea. The form of the genae, the large eyes and the anterior pronotal angles suggest a mere extension of the development found in *Silvanus*, while the general facies is similar to that of the American *Pensus*. However, the ♂ genitalia and sternites 8 and 9 (Text-figs 84–88) are different and although the occurrence of a tooth and ridge on the metafemur in both sexes may be a specific character it is, nevertheless, unique. The genus is closely related to *Silvanus* and shared characters are not included in the following description. *Dorsal surface* with puncturation dense, ocellate; pubescence obvious, consisting of short golden decumbent setae on head and thorax, similar setae directed caudad and forming obvious double rows along elytral interstriae. *Head* transverse; genae strongly produced, triangular; eyes large, prominent. *Pronotum* with extremely well developed prominent anterior angles and distinct posterior angles. *Elytra* with tuberculate setiferous punctures on interstriae; strial punctures deep. See specific description regarding secondary sexual characters. *Genitalia* ♂ (Text-figs 84–87) with median lobe acuminate at apex; parameres not forked, broad at apex with a few short setae.

### ***Calpus bacchi*** **sp. n.**

(Text-figs 84–88, 95–97)

Length 2·60–3·17 mm. *Head* broader than long (12·7–13·3 : 10), narrower than pronotum (ratio of breadth across eyes to that across pronotal anterior angles 10 : 11·9–11·6); puncturation coarse and rugose, interspaces shining and bearing ocellate setiferous punctures; genae strongly produced laterally, triangular (Text-fig. 96); eyes large and prominant (1·9–2·2 times as long as broad); temples virtually absent (about half as long as an eye-facet). *Pronotum* (Text-fig. 96) longer than broad (12·3–12·6 : 10); puncturation as on head, general appearance rather granular; anterior angles very strongly produced anteriorly, curved and tapered to apex (Text-figs 96, 97); disc with a deep basal and shallow apical depression. *Elytra* 2·0–2·2 times as long as broad; setal punctures strongly tuberculate, giving elytra a rather granular appearance; strial punctures deep, interstriae slightly raised; explanation at sides of elytra as broad as a stria. *Ventral side* with coarse, dense and tuberculate puncturation on head, prosternum and mesosternum; disc of metasternum and abdominal sternites with tubercles, surface of



Figs 98–108. *Cathartosilvanus*, male genitalia. 98–101, *C. vulgaris* (Grouvelle). 99, Internal sac. 100, Parameres of different specimens. 101, Apex of median lobe. 102–103, *C. tropicalis* (Van Dyke). 102, Paramere. 103, Apex of median lobe. 104–105, *C. trivialis* (Grouvelle). 104, Parameres of different specimens. 105, Apex of median lobe. 106–107, *C. imbellis* (LeConte). 106, Paramere. 107, Apex of median lobe. 108, *C. vulgaris* (Grouvelle) sternites 8 and 9.

abdominal sternites reticulate and shining. *Legs.* Metafemur in both sexes with a large tooth on anterior margin and a ridge on posterior margin. In ♂ (Text-fig. 95) an additional ridge on ventral side of metafemur; metatibia with a row of small spinules (absent in ♀). *Genitalia* ♂, Text-figs 84–87, sternites 8 and 9, Text-fig. 88.

Holotype ♂, length 3·17 mm, NEW GUINEA: Madang Distr., Finisterre Mts, Damanti, 3,550 ft, 2–11.x.1964 (*M. E. Bacchus*) (BMNH, London).

Paratypes. 1 ♂ with same data as holotype (BMNH, London); 1 ♂, NEW GUINEA: Adelbert Mts, Wanuma, 800–1000 m, 24.x.1958 (*J. L. Gressitt*) (BPBM, Honolulu); 2 ♀♀, 1 ♂, NEW IRELAND: ridge above 'Camp Bishop', 15 km up Kait R., 250–750 m, 13.vii.1956, light trap (*G. L. Gressitt*) (BPBM, Honolulu).

COMPARATIVE NOTES. Similar to the American *Pensus gilae* and *P. guatemalenus*. It may be distinguished from these species by the form of its head, pronotum and its legs. The puncturation of the head is less ocellate in this species than in *Pensus*.

## ***CATHARTOSILVANUS*** Grouvelle **stat. n.**

*Silvanus* (*Cathartosilvanus*) Grouvelle, 1912 : 340. Type-species: *Silvanus trivialis* Grouvelle, by monotypy.

Number of species: 4.

Length 1·7–2·83 mm; general facies, pubescence, etc., rather similar to *Silvanus*, and characters are described here only when they differ or exhibit a different range of variation. *Head* transverse to slightly longer than broad; densely punctured, sometimes with punctures grouped to form large foveolate punctures (*imbellis*); genae slightly raised dorsally; temples short (as long as 1·5 eye-facets) to virtually absent. *Thorax* with pronotum quadrate (but appearing transverse) to elongate (12·4 : 10); anterior margin slightly depressed medially, lateral thirds or less, obviously sloped backwards to anterior angles; anterior angles poorly to well developed but quite different from *Silvanus* (Text-figs 109–111, 114); posterior angles well-defined; disc may be slightly depressed towards base and apex. *Legs* without secondary sexual characters (*trivialis*) or in ♂, metafemur with a short ridge or carina on posterior margin, metatibia with a row of spinules in same position. *First visible abdominal sternite* with femoral lines open, i.e. bordering metacoxal cavity mesally for a short distance then diverging and traversing part of segment (e.g. Text-fig. 112); in ♂ *vulgaris* this sternite usually bears a median longitudinal carina. *Genitalia*, aedeagus with median lobe rounded to very slightly tapered at apex; parameres not forked, elongate with long setae (3 or 4) at apex (Text-figs 100–106) intraspecifically variable; internal sac as in Text-fig. 99 or in *tropicalis* complex chitinous structure ill-defined and short; ♂ abdominal sternites 8 and 9 as in Text-fig. 108.

DISTRIBUTION. Nearctic and Neotropical.

### KEY TO THE SPECIES OF *CATHARTOSILVANUS*

1 Pronotum as broad or broader than long (breadth : length, 10–10·5 : 10), sides short, giving pronotum transverse appearance.
Anterior angles of pronotum weakly developed (Text-fig. 114); largest punctures on head not broader than half eye-facet; length 1·7–2·1 mm. Neotropical and Arizona of Nearctic . . . **trivialis** (Grouvelle) (p. 84)

Pronotum longer than broad (length : breadth, 10·5–12·4 : 10), species with a shorter pronotum having well developed anterior angles . . . . . 2

2 (1) Pronotum with sides more or less parallel, anterior angles little produced, inconspicuous (Text-fig. 111); ratio of pronotal length : breadth 11·5–12·4 : 10. Nearctic (and Brazil? see description) . . . **imbellis** (LeConte) (p. 82)

– Pronotum with sides usually rounded (rarely straight), anterior angles well produced, obvious; ratio of pronotal length : breadth 10·5–11·2 : 10. Neotropical . . . . . . . . . . . . . . 3

3 (2) Anterior angles of pronotum rounded (Text-fig. 110); head and pronotum darker than elytra. Galapagos Is. . . . . **tropicalis** (Van Dyke) (p. 86)

Anterior angles of pronotum more or less pointed (Text-fig. 109); body unicolorous. Neotropical . . . . . **vulgaris** (Grouvelle) (p. 85)

## ***Cathartosilvanus imbellis*** (LeConte) **comb. n.**

(Text-figs 106, 107, 111–113)

*Silvanus imbellis* LeConte, 1854 : 77. LECTOTYPE ♀ (here designated, see below), U.S.A.: Georgia (MCZ, Massachusetts) [examined].

? *Silvanus communis* Grouvelle, 1878 : 75. Syntypes, sex indet., BRAZIL. See below.

Length 2·42–2·83 mm. Moderately shining. *Head* broader than long (12·2–12·4 : 10), narrower across eyes than pronotum across anterior angles (10 : 11·3–11·7); puncturation coarse, dense and deep towards eyes and back of head where largest punctures as broad as twice an eye-facet diameter, clypeus and frontal triangle with finer punctures (breadth less than eye-facet) separated by up to 2 diameters, and often grouped to form large foveolate punctures; eye small, almost three times as long as broad, separated from clypeogenal emargination by slightly less than its length; temple very small less than a quarter of eye-facet diameter, post-genal area (ventral) broader than half an eye-breadth, eyes separated beneath head by about four times breadth. *Pronotum* (Text-fig. 111) longer than broad (11·5–12·4 : 10) in large males particularly elongate; punctures deep and dense, tending to be longitudinally confluent; anterior margin as in other *Cathartosilvanus* (see Text-figs), anterior angles poorly developed; sides more or less straight; disc with a very slight depression towards base, sometimes with a median longitudinal carina along median half or two-thirds; basal margin without a rim medially; posterior angles ill-defined, obtuse; prosternal punctures deep, prosternal process with a median depressed line but not deeply channelled as in *vulgaris*, puncturation coarse and deep; meso- and metasternum and abdominal sternites with deep punctures separated by 1–2 diameters (slightly larger than an eye-facet diameter). *Elytra* 2·1–2·3 times as long as broad; strial punctures deeper and interstriae more strongly raised than in *vulgaris* and *trivialis* but arrangement of interstrial setiferous punctures similar; lateral margins not explanate. *Legs* in ♀ simple, in ♂ metafemur with a characteristic carina towards apex of posterior margin (Text-fig. 113) metatibia with a row of spinules along posterior margin. *Genitalia* ♂, median lobe and paramere, Text-figs 106 and 107.

Number seen: 200+.

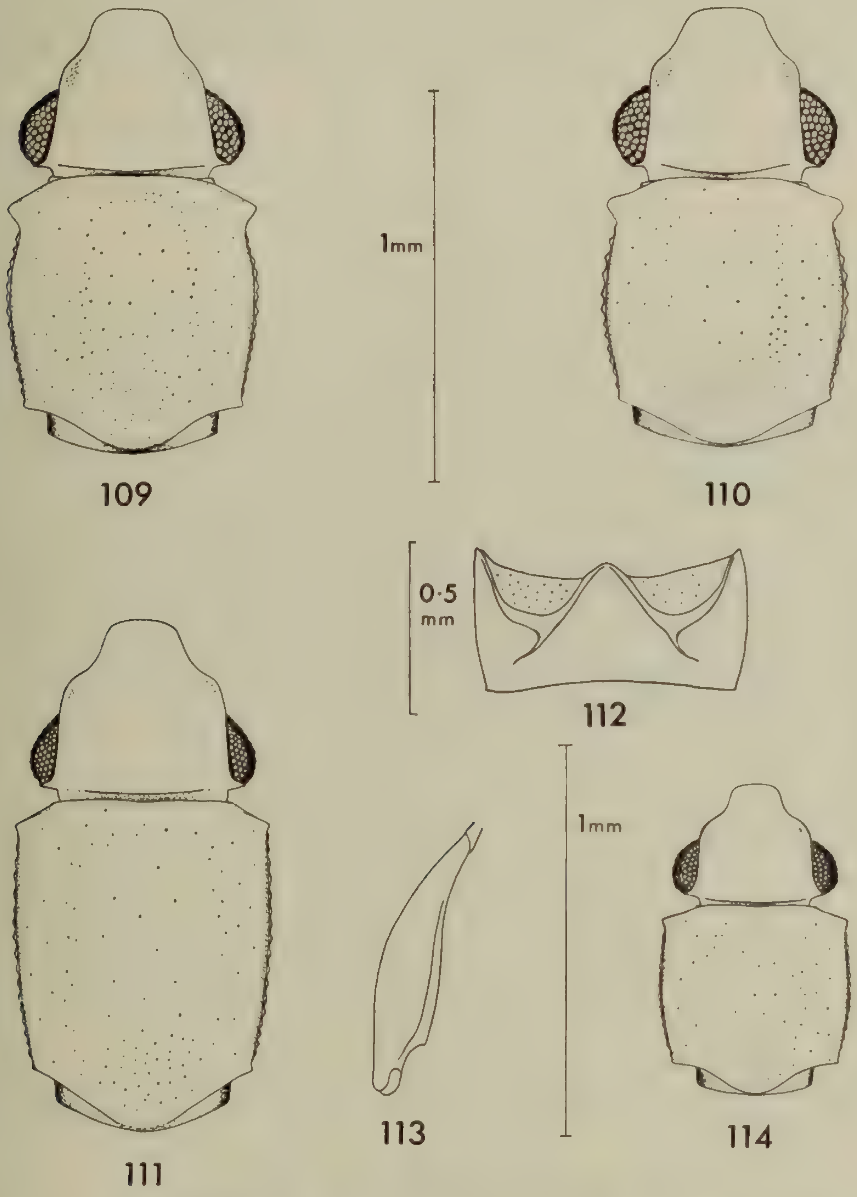
Lectotype of *imbellis* LeConte, present designation, ♀, length 2·70 mm, mounted on a small card point, bearing an orange card disc which indicates south-eastern states as the locality and with 'Type 6777 [red label]/S. imbellis Lec [MS]'. Paralectotype ♀ with an orange disc and small card mount as lectotype.

The type-locality given for *imbellis* is 'Georgia'. LeConte's collection in the Museum of Comparative Zoology, Massachusetts, contains only the above two specimens from the correct region and I have accepted them as syntypes.

I have not found the types of Grouvelle's *communis* (described from Brazil, Grouvelle and Reitter collections, and also recorded from Columbia by Grouvelle,

1912) and, while his description and figure suggest that his species and *imbellis* are the same, I have not seen Neotropical material of *imbellis*.

Comparative notes. Closely related to *trivialis* and *vulgaris* but easily dis-



Figs 109–114. *Cathartosilvanus*. 109, *C. vulgaris* (Grouvelle) head and pronotum. 110, *C. tropicalis* (Van Dyke), same. 111–113, *C. imbellis* (LeConte) same. 112, 1st (visible) abdominal sternite. 113, Metatrochanter and femur of ♂. 114, *C. trivialis* (Grouvelle) head and pronotum.

tinguished by the elongate pronotum, head puncturation and the deeper punctures on the abdominal sternites.

Distribution. Nearctic and, if *communis* is synonymous, Neotropical. CANADA: Ontario and Quebec. U.S.A: Oregon, Nebraska, Iowa, Illinois, Kansas, Texas, Louisiana, Michigan, Indiana, Ohio, New York, Massachusetts, Pennsylvania, W. Virginia, Maryland, New Jersey, N. Carolina, Alabama, Georgia, S. Carolina. In USNM, Washington and CAS, California.

Habitats. This species has been found under bark of *Castanea* and *Quercus*.

### ***Cathartosilvanus trivialis*** (Grouvelle)

(Text-figs 104, 105, 114)

*Silvanus trivialis* Grouvelle, 1878 : 75. Syntypes, Brazil [not seen].
*Silvanus* (*Cathartosilvanus*) *trivialis* Grouvelle, 1912 : 340.

Length 1·7–2·1 mm. A small species. *Head* broader than long (10·5–12·8 : 10), narrower across eyes than pronotum across anterior angles (10 : 10·8–11·14): puncturation similar to that in *vulgaris*, largest punctures not broader than half an eye-facet; eye 2·3–2·9 times as long as broad, separated from clypeogenal emargination by about half its length; genae, temples, breadth of post-genal area and ventral separation of eyes as in *vulgaris*. *Pronotum* (Text-fig. 114) as broad as, or slightly broader than long (10–10·5 : 10) but appears more strongly transverse due to the more or less straight short sides (ratio of length of side to breadth 10 : 13·5–14·2); puncturation, anterior margin and posterior angles as in *vulgaris;* anterior angles very poorly to moderately developed – Text-fig. 114; disc very slightly depressed behind apical tenth, strongly depressed in front of basal tenth; basal margin sometimes with a distinct rim; prosternal process with longitudinally rugose puncturation between coxae (not deeply channelled) slightly depressed before apex. *Elytra* 1·8–2·0 times as long as broad, as in *vulgaris*. Apparently without secondary sexual characters. *Genitalia* ♂, median lobe, Text-fig. 105, parameres variable, Text-fig. 104.
Number seen: 250.

Comparative notes. This species is closely related and similar to *vulgaris*, from which it may be distinguished by the form of the prothorax and its smaller size.

Distribution. Neotropical and into Nearctic. U.S.A.: California, Coachella Valley and Los Angeles Co.; Arizona, Graham Mts and San Carlos; Mexico: Alamos, Durango, nr Rio Santiago Ferry, Sonora, Tamazunchale, Teapo and Veracruz (Port). Guatemala: Alta v. Paz, Rio Chagres, Senhau and Zapote; British Honduras: Rio Hondo (Sharp, 1899); Honduras: Lombardia; Costa Rica: Limon, Rio Banano, Santa Clara and San José; Panama: Barro Colorado, Pearl Is, San José, Polochi River and Tabernilla (Canal Zone); Ecuador: nr Santa Rosa; Brazil: Corumba; Bolivia: Yoay; Cuba: Cayamas; Jamaica: Clarks Town and Santa Cruz; Leeward Islands: Grenada, Guadelope, and St Vincent. In BMNH, London; CAS, California; USNM, Washington; ZM, Berlin.

Habitats. *S. trivialis* has been imported to the U.S.A. on egg plants from Cuba, bananas from Guatemala, Mexico and Ecuador [not included in the above distribution list], pineapples from Mexico and Honduras. It has been found on cedar and mahogany logs (Honduras) and *Primavera* log (Guatemala). A large number of well-labelled specimens has been seen from Costa Rica (Nevermann Collection USNM, Washington) and these came from the following 'habitats': on dried fruit of *Musa textilis* Née (Manilla hemp) and dried leaves of *M. sapientum* (banana); on withered (welkem) foliage of *Saccharum officinarum* L. (sugar-cane), *Ochrome limonensis* Rowlee (cotton tree) and *Muntingia;* under loose bark – many records; in nest of weaver-bird, *Gymnostinops* and at light, also many records.

### ***Cathartosilvanus vulgaris*** (Grouvelle) **comb. n.**

(Text-figs 98–101, 108, 109, 127, 128)

*Silvanus vulgaris* Grouvelle, 1878 : 74. LECTOTYPE ♀ (here designated, see below), MEXICO (MNHN, Paris) [examined].

Length 2·26–2·78 mm. Rather dull. *Head* as broad or slightly broader than long (11·3 : 10), narrower across eyes than pronotum across anterior angles (10 : 11·1–11·5); everywhere densely punctured, clypeus and frontal triangle which extends to middle of head with irregular punctuation, punctures smaller than those at sides of head, largest 2/3 as long as an eye-facet; eye 2·5–3·0 times as long as broad, separated from clypeogenal emargination by half or less of its length; genae slightly raised above antennae to form a rim; temples virtually absent; eyes separated beneath head by twice or less of breadth; post-genal area (between submental sutures and eye) much narrower than half an eye-breadth; maxillary palp, Text-fig. 127, labial palp, Text-fig. 128. *Pronotum* (Text-fig. 109) a little longer than broad (10·8–11·2 : 10), general facies rounded (a few specimens have been seen with sides much straighter than in Text-fig. 109); densely punctured with coarse punctures (as broad as 1–1·5 eye-facet diameters); anterior margin slightly depressed medially, lateral thirds sloped backwards to anterior angles (see Text-fig. 109); anterior angles acute, well developed; disc with a small shallow depression behind apical tenth and a large deeper depression near base; basal margin without a rim medially; posterior angles almost right-angles; prosternal process obviously channelled between coxae and broadly depressed before apex, apical punctuation may appear longitudinally rugose. *Elytra* twice as long as broad; strial punctures separated longitudinally by a little less than diameter of a puncture; interstriae as broad as 1–1·5 strial punctures, flat or slightly raised, sutural interstria with a single row of tuberculate setiferous punctures, then alternate interstriae with double/single rows of these punctures, the double rows impinging on strial interspaces; lateral margins explanate from just below humeri to near apices and bearing a single row of tuberculate setiferous punctures. In ♂, first *abdominal sternite* usually with a median longitudinal carina, absent in ♀. *Legs* in ♀ simple, in ♂ metafemur with a short low ridge on basal quarter of posterior margin and metatibia with a row of spinules along posterior margin. *Genitalia* ♂, Text-fig. 98, internal sac, Text-fig. 99, parameres extremely variable, two forms illustrated in Text-fig. 100, apex of median lobe, Text-fig. 101, sternites 8 and 9, Text-fig. 108.

Number seen: 50.

Lectotype, present designation, ♀, length 2·72 mm, with 'Nov [MS]/Mexique Cordoba (Salle) [MS of Grouvelle on green label]/Type[ptg.]/Silvanus vulgaris (Salle) Cordoba Mexique [MS]'.

COMPARATIVE NOTES. See *trivialis* and *tropicalis.*

DISTRIBUTION. Neotropical. MEXICO: Cordoba (type-locality), Guanajuato; Nayarit and Oaxaca Monte Alban; GUATEMALA: S. Geronimo and Zapote; COSTA RICA: Reventazon, San José and Terris de Barba; PANAMA: nr Boquete; COLOMBIA:

nr Sasoima; Brazil: Sta Catharina; Argentina: Tabilias Saita. In BMNH, London; CAS, California; MNHN, Paris; USNM, Washington and ZM, Berlin.

Habitats. This species has been imported to Britain on Brazil nuts from Belon and on Brazilian cocoa beans. In Costa Rica (Nevermann Collection USNM, Washington) it has been collected at light, on fruits of *Musa textilis* Née (Manilla hemp), dead leaves of *Sechium edule* Swartz, and under loose bark.

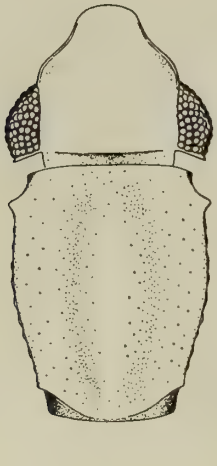
### ***Cathartosilvanus tropicalis*** (Van Dyke) **comb. n.**

(Text-figs 102, 103, 110)

*Silvanus tropicalis* Van Dyke, 1953 : 62. Holotype sex indet., Galapagos Is. (CAS, California) [paratypes examined].

The following description is based on two paratypes (♂, ♀) which are in the CAS, California; measurements etc., are quoted for the ♂ first. This species is similar to *vulgaris* and characters are described only when they differ from that species.

Length 2·65, 2·76 mm. A rather dull coarsely punctured species with head and pronotum darker than elytra. *Head* slightly broader than long (11·7, 11·5–10) across eyes slightly narrower than pronotum across anterior angles (10 : 10·2, 10·6), densely punctured, largest punctures at side of head larger than eye-facets; eyes large and prominent, 2·1, 2·3 times as long as broad. *Pronotum* (Text-fig. 110) a little longer than broad (11·0, 10·5 : 10), puncturation coarse and dense, towards sides punctures becoming as broad as 1·5 eye-facets or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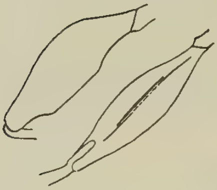
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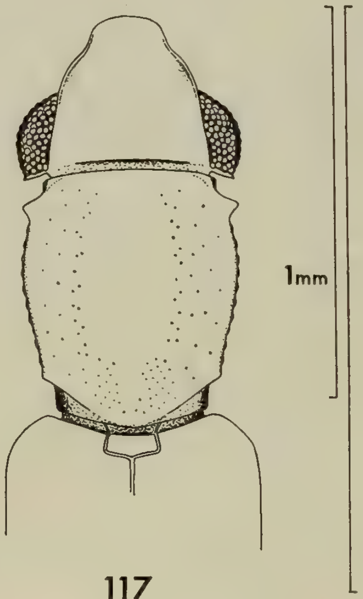

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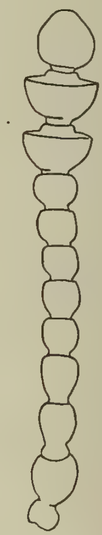
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Figs 115–118. *Silvanoides* gen. n. 115–116, *S. foveicollis* sp. n. 115, Head and pronotum. 116, Male metatrochanter and femur, side and ventral views. 117–118, *S. cheesmanae* sp. n. 117, Head and pronotum. 118, Antenna.

more; anterior angles well developed, rounded; disc with a distinct depression towards base. *Elytra* 1·8 times as long as broad. *Legs* in ♀ simple, in ♂ tibia with denticles on posterior margin (in ♂ examined femur without a distinct ridge). *Genitalia* ♂, paramere Text-fig. 102, apex of median lobe Text-fig. 103.

Holotype and three paratypes from Indefatigable I., Galapagos Is. (no habitat data given) in CAS, California, and one paratype in BMNH, London.

COMPARATIVE NOTES. This species may be distinguished from *vulgaris* by its rounded anterior angles, coarser puncturation, comparatively larger eyes and broader appearance.

DISTRIBUTION. Neotropical. ECUADOR: Galapagos Is.

## *SILVANOIDES* gen. n.

Type-species: *Silvanoides cheesmanae* sp. n.
Number of species: 2.

Length 2·42–2·6 mm; this genus has many characters in common with *Silvanus*, and these are not included in the following description. *Head* transverse (for description of puncturation see specific descriptions); sides of head with a rim, fine on clypeus becoming broader and raised on genae (Text-figs 115–117). *Antennae* (Text-fig. 118) with scape a little longer than segment 2, segments 4–8 quadrate to transverse, segment 8 more transverse than 7, club segments 9 and 10 more transverse and general appearance more moniliform than in *Silvanus*. *Eyes* large, temples very narrow extending laterally as platform beneath eye (see Text-fig. 115), similar to some *Protosilvanus*. *Pronotum* with puncturation much coarser than on head; anterior angles small, lateral and rather variable (similar to *Cathartosilvanus*); serration on side margins not as obvious as in *Silvanus* (about 10–15 denticles); posterior angles well-defined. *Legs* simple in ♀, in ♂ metatrochanter with a slight apical prominence, metafemur with a ridge on ventral side. *Elytra* with epipleura broad, tapering to apex. *First visible abdominal sternite* with femoral line open, short, see Text-fig. 119. *Genitalia* ♂ (Text-figs 121–126) with median lobe tapered to apex, parameres characteristic, bearing two long setae on one side of apex and a short process with fine setae on the other, Text-fig. 123; ♂ sternites 8 and 9 as in Text-fig. 120.

DISTRIBUTION. Oriental.

### KEY TO SPECIES OF *SILVANOIDES*

| | | |
|---|---|---|
| 1 | Pronotum with distinct lateral foveae . . . . | ***foveicollis*** sp. n. (p. 88) |
| – | Pronotal disc slightly depressed on each side . . . | ***cheesmanae*** sp. n. (p. 87) |

## *Silvanoides cheesmanae* sp. n.

(Text-figs 117, 118, 125, 126)

Length 2·42–2·52 mm. *Head* broader than long (13·8–14·7 : 10), as broad or slightly broader across eyes than pronotum across anterior angles (10·0–10·4 : 10); puncturation irregular, a mixture of fine and coarse punctures, largest punctures towards side of head not more than half an eye-facet diameter, interspaces shining; lateral rim moderately developed above genae; eye large and prominent, temple equivalent to about half an eye-facet diameter; antenna, Text-fig. 118. *Pronotum* (Text-fig. 117) 1·14—1·18 times as long as broad, with a comparatively finely and sparsely punctured shining region medially on disc, punctures towards sides and base abruptly becoming extremely coarse, largest punctures equal to 1·5 eye-facets in diameter; anterior angles small, variable (Text-fig. 117); obviously lower than anterior margin, disc very slightly depressed on each side, depressions more obvious towards base. *Elytra* 2·16–2·28 times as long as broad. *Legs*, in ♂ metatrochanter with a very small prominence, metafemur with a ridge on median third similar to *foveicollis* but shorter, less prominent and more oblique. *Genitalia* ♂, as in Text-figs 125, 126.

Holotype ♀, length 2·52 mm, New Guinea: Cyclops Mts, Sabron, 2,000 ft, vi.1936 (*L. E. Cheesman*).

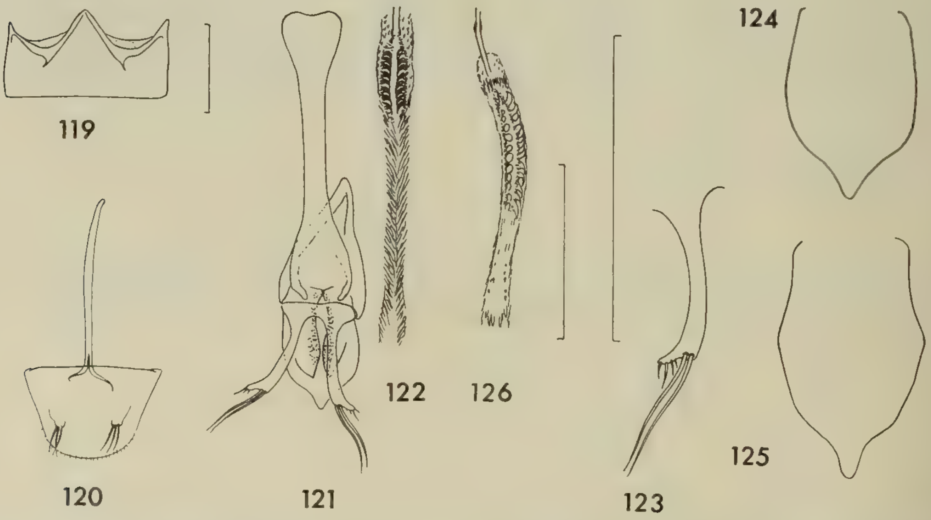
Paratypes (6). 1 ♀, New Guinea, Kodoka, 1,200 ft, viii. 1933 (*L. E. Cheesman*); 1 ♀, Finschhafen, 9.v.1944 (*E. S. Ross*); 1 ♂ and 1 ♀, Solomon Is: Choiseul Is., Malangono, 29.viii.1963 (*P. J. M. Greenslade*) 9262; 1 ♀, Malaita, Small Malaita, 11.vii.1966 (*P. J. M. Greenslade*) 23319; 1 ♀, Philippine Is: Mindoro, San Jose, 30.i.1945 (*E. S. Ross*). The two specimens collected by Ross are in the CAS, California, and the holotype and other paratypes in the BMNH, London.

Distribution. Philippine Is, New Guinea and Solomon Is.

## *Silvanoides foveicollis* sp. n.

(Text-figs 115, 116, 119–124)

Length 2·43–2·64 mm. *Head* broader than long (12·9–14·1 : 10) slightly broader across eyes than pronotum across anterior angles (10·1–10·6 : 10); puncturation variable, may be denser and less uneven than in *cheesmanae* but otherwise similar to this species; lateral rim



Figs 119–126. *Silvanoides* gen. n. 119–124, *S. fovicollis* sp. n. 119, 1st visible abdominal sternite. 120, Sternites 8 and 9 of ♂. 121, Male genitalia. 122, Internal sac. 123, Paramere. 124, Median lobe. 125–126, *S. cheesmanae* sp. n. 125, Median lobe. 126, Internal sac. Scale lines = 0·3 mm.

well developed above genae; eye large and prominent, temple short as in *cheesmanae*. *Pronotum* (Text-fig. 115) elongate 1·29–1·41 times as long as broad, with obvious longitudinal foveae which, like sides, are coarsely punctured, particularly so towards base where largest punctures are as long as 1·5 eye-facets; anterior angles small, slightly lower on side margin than in *cheesmanae* (see Text-figs). *Elytra* 2·18–2·21 times as long as broad. *Legs* (Text-fig. 116) in ♂ metatrochanter with a very small prominence, metafemur with a ridge along middle third of ventral side. *Genitalia* ♂, Text-figs 121–124, ♂ sternites 8 and 9, Text-fig. 120.

Holotype ♂, length 2·43 mm, SOLOMON IS: Guadalcanal, Mt Austen, 11.ii.1965 (*P. J. M. Greenslade*) 15687. Paratypes, 1 ♀ and 1 ♂, SOLOMON IS: Choiseul Is, Malangono, 25.viii.1963 (*P. J. M. Greenslade*) 9262. All types in BMNH, London.

COMPARATIVE NOTES. This species, which is extremely closely related and similar to *cheesmanae*, may be distinguished by its more tapered and elongate pronotum which has distinct longitudinal foveae and by its pubescence, which is more obvious. The ♂ genitalia in *foveicollis* has the apex of the median lobe (in specimens seen) less tapered than in *cheesmanae* and the internal sac is different (see Text-figs).

## ***PROTOSILVANUS*** Grouvelle **stat. n.**

*Silvanus* (*Protosilvanus*) Grouvelle, 1912 : 336. Type-species: *Silvanus lateritius* Reitter, by PRESENT DESIGNATION.

Number of species: 5.

Length 2·00–4·23 mm; depressed and elongate, moderately shining to dull, reddish to yellowish brown, one species with bicoloured prothorax and fasciate elytra; surface with fine decumbent golden pubescence. *Head* transverse, puncturation dense to sparse, ocellate at sides; clypeal margin almost straight, clypeogenal emargination slightly depressed above but not foveolate; genal margin hardly raised above antennae. *Antennae* similar to *Silvanus* but segments rather more transverse and some species with distinct spines on lateral margins of club segments 9 and 10 (Text-fig. 144). *Eye* large, temples very short, either shelf-like (Text-fig. 143) or similar to Text-fig. 138. *Mouth parts* similar to *Parasilvanus* (Text-figs 129, 130, labial and maxillary palps). *Thorax* with pronotum elongate (12·5–16·4 : 10); puncturation similar to that on head; anterior margin more or less straight; anterior angles very poorly to moderately developed, not tapered to apex; side margins finely serrate; posterior angles well- or ill-defined; medially, posterior margin not confluent with rim of foramen; disc slightly to moderately depressed on each side of mid-line, which may be slightly carinate. *Scutellum* transverse. *Prosternum* with sternopleural sutures ill-defined, meeting lateral margin at about apical one-fifth, where there is first indication of development of anterior angle, procoxal cavities broadly closed behind, prosternal process not much narrower medially than apex, slightly depressed or sulcate behind apical margin. *Mesosternal* apex not much narrower than that of prosternal process (both very broad when compared with *Silvanus*). *Metasternum* with median line complete or becoming obsolete at or within basal half (i.e. towards mesosternum). *Legs* with tarsi 5-segmented, penultimate segment very small, segment 3 simple; secondary sexual characters exhibited by ♂ as follows: metatrochanter with a prominent spine on inner apex, metatibia usually with a tooth on posterior margin near apex, sometimes tooth also present on mesotibia. *Elytra* each with 9 rows of punctures forming striae; interstriae either with alternate single and double rows of setae or with single row on 1 and double rows on 2–4 then alternate rows; interstria 1 (sutural) slightly raised, interstria 7 strongly or moderately carinate, either other interstria very slightly raised or, in *carinatus*, 5 slightly raised at base and 3 carinate for greater part of its length; not explanate at sides; epipleura broad, tapering to apex. *Wing* well developed, similar to *Silvanus*. *Metendosternite* without a stem. *First visible sternite of abdomen* with femoral line closed as in *Silvanus*, in ♂ abdominal sternites may have tubercles (*carinatus* and *fasciatus*). *Genitalia*, ovipositor similar to *Silvanus* but with styli and valvifers comparatively broader; aedeagus with median strut as in Text-fig. 134 or tapered to apex, Text-fig. 141, parameres broad at apex and bearing 3 or 4 long and several shorter setae, median lobe as illustrated, internal sac with complex chitinous structure very short (*lateritius*, Text-fig. 135) or long.

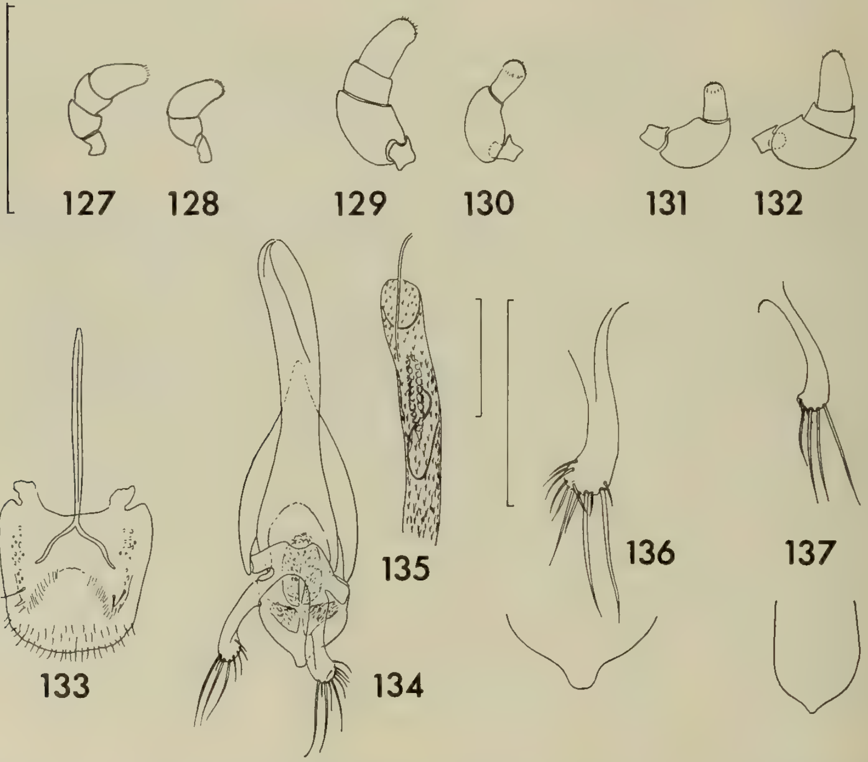
DISTRIBUTION. Oriental.

### KEY TO THE SPECIES OF *PROTOSILVANUS*

1 Interstria 3 strongly carinate for at least basal three-quarters. Sumatra and Singapore . . . . . . . . **carinatus** Grouvelle (p. 93)

– Interstria 3 flat or slightly raised, not carinate . . . . . . . 2

2 (1) Anterior angles of pronotum as in Text-figs 138, 146 or 147; dull; median line on metasternum almost complete; elytra fasciate or unicolourous; smaller species, 2·0–3·14 mm . . . . . . . . . . . 3



FIGS 127–137. 127–128, *Cathartosilvanus vulgaris* (Grouvelle). 127, Maxillary palp. 128, Labial palp. 129–130, *Protosilvanus lateritius* (Reitter). 129, Maxillary palp. 130, Labial palp. 131–132, *Parasilvanus ocellatus* (Grouvelle). 131, Labial palp. 132, Maxillary palp. 133–136, *Protosilvanus lateritius* (Reitter). 133, Sternites 8 and 9 of ♂. 134, Male genitalia. 135, Internal sac. 136, Paramere and apex of median lobe. 137, *Protosilvanus granosus* (Grouvelle) same. Scale lines = 0·2 mm.

– Anterior angles of pronotum poorly developed, not as in above Text-figs; shining; median line on metasternum ill-defined (at least on basal quarter) or absent on basal half; elytra unicolourous; larger species, 2·14–4·23 mm . . 4

3 (2) Elytra with a broad dark fascia, lighter regions forming ill-defined patches; interstria 7 strongly carinate; eyes smaller (Text-fig. 138); antennal segment 8 less transverse (Text-fig. 139). Fiji . . . ***fasciatus*** sp. n. (p. 91)

– Elytra unicolorous; interstria 7 moderately (sometimes weakly) carinate; eyes larger; antennal segment 8 more transverse. Oriental ***granosus*** (Grouvelle) (p. 93)

4 (2) Shining, pubescence inconspicuous (sparse); discal depressions of pronotum with sparse puncturation on apical half; prosternal process with a deep sulcus behind apical margin; head and pronotum as in Text-fig. 145. New Caledonia ***inaequalis*** (Grouvelle) (p. 95)

– Moderately shining, pubescence obvious (relatively dense); pronotum with puncturation everywhere dense, prosternal process shallowly depressed behind apical margin; head and pronotum as in Text-fig. 143. Oriental ***lateritius*** (Reitter) (p. 96)

## ***Protosilvanus fasciatus*** sp. n.

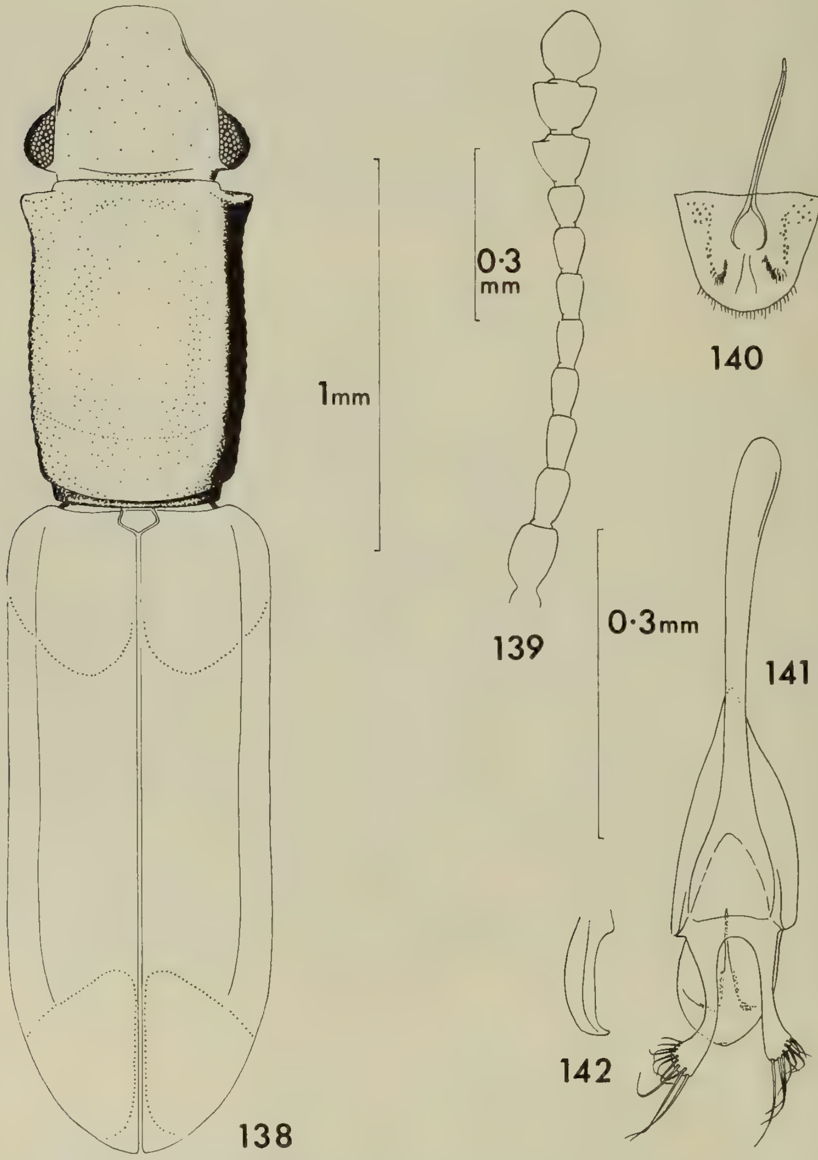
(Text-figs 138–142)

Length 2·72–2·96 mm. Dull, surface with rather granulate appearance; head and apical two-thirds to three-quarters of pronotum light reddish brown, basal region of pronotum, middle half and extreme apices of elytra dark brown (lighter regions forming patches, Text-fig. 138). *Head* broader than long (11·3–12 : 10) with ocellate setiferous punctures dominant, some small deep punctures on frontal triangle; ventral puncturation similar to prosternum, appearing granulate. *Eye* separated from clypeogenal emargination by its length, smaller than in other *Protosilvanus*. *Antenna*, Text-fig. 139. *Pronotum* (Text-fig. 138) puncturation as on head; elongate, 14·5–16·4 : 10, broader or narrower across anterior angles than head across eyes (10·2 : 10 or 10 : 10·1); anterior angles well developed; disc with shallow lateral depressions, ill- or well-defined medially, apical limit obvious, without a median carina; posterior angles ill-defined; basal margin separate from rim of foramen. *Thoracic sternites* with tuberculate setiferous punctures, tubercles on metasternal disc often less pronounced than elsewhere – general appearance of sternites granulate. Prosternum with some coarse punctures towards coxal cavities, apical fifth with ill-defined rugosity, apical eighth raised; prosternal process slightly depressed medially. Metasternum shallowly depressed on each side of disc, median line becoming obsolete towards mesosternum. *Elytra* 2·48–2·70 times as long as broad; strial punctures deep; interstriae 3 and 5 slightly raised at base, 7 carinate to approximately apical fifth (Text-fig. 138). *Abdominal sternites.* Not as dull as rest of ventral surface, setae arising from slightly raised areas. In ♀ sternites 1 and 2 with disc slightly depressed, in ♂ these sternites with shallow but distinct depressions, sternite 3 of ♂ with a median tubercle near caudal margin. *Legs* simple in ♀, in ♂ metatrochanter with a small protuberance, metatibia with a small lamellate tooth towards apex (as in Text-fig. 152). *Genitalia* ♂, Text-figs. 141–142, sternites 8 and 9 Text-fig. 140.

Holotype ♂, length 2·72 mm, dissected, FIJI Is.: Taveuni, Waiyeve, 21.vi.1924 (*Dr H. S. Evans*).

Paratypes. 4 with same data as holotype and 6 with same data but collected 7.i.1924. Each specimen also bears a label with a pencilled number as follows, holotype: 158.24, paratypes: 155.24, 156.24, 157.24, 159.24, 1652.24, 1653.24, 1654.24, 1656.24, 1658.24, 1659.24. All types in BMNH, London.

COMPARATIVE NOTES. The fasciate elytra of this species distinguish it from all others described in this revision. Teneral specimens might be confused with *granosus;* the latter, however, has larger eyes, a more transverse antennal segment 8 and less pronounced elytral carinae. The bent apex of the median lobe of the ♂ genitalia (Text-fig. 142) is also diagnostic for *fasciatus*.



FIGS 138–142. *Protosilvanus fasciatus* sp. n. 139, Antenna. 140, Sternites 8 and 9 of ♂. 141, Male genitalia. 142, Median lobe, lateral view.

## ***Protosilvanus granosus*** (Grouvelle)

(Text-figs 137, 146, 147)

*Silvanus granosus* Grouvelle, 1897 : 396. LECTOTYPE ♂ (here designated, see below), SUMATRA (MNHN, Paris) [examined].
*Silvanus* (*Protosilvanus*) *granosus* Grouvelle, 1912 : 336.

Length 2·00–3·14 mm. General appearance dull; ventral surface dull and with small tubercles, which are particularly obvious at sides of metasternum and abdominal sternites. *Head* broader than long (12·4–13·2 : 10) moderately shining on clypeus and disc of vertex; sides of head with ocellate setiferous punctures on interspaces of slightly larger punctures, puncturation elsewhere not so obviously ocellate; antennae with segment 8 more transverse than in *lateritius*. *Pronotum* slightly to moderately elongate (12·5–15·2 : 10); puncturation as on sides of head; anterior angles usually prominent (Text-fig. 147), sometimes less produced (Text-fig. 146), always more evident than in *lateritius* and except in the smallest specimen seen (ratio 10 : 10·3) pronotum slightly broader across anterior angles than head across eyes (10·2–10·9 : 10); disc shallowly depressed, median ridge absent or ill-defined. *Thoracic sternites*. Prosternum with weak transverse rugosity on apical third, apical eighth raised; prosternal process with a shallow depression before apex, apical margin rather granulate; mesosternum slightly depressed; metasternum with median line well-defined from near base to apex. *Elytra* 2·41–2·68 times as long as broad, puncturation as in *lateritius;* interstriae 1 (sutural), 3 and 5 slightly raised, 7 moderately (sometimes weakly) carinate. *Legs*. In ♂ metatrochanter with a prominent spine on inner apex, in ♀ simple. *Genitalia* ♂, Text-fig. 137.

Number seen: 37.

Lectotype, present designation, ♂ with 'Sumatra [Grouvelle's MS] Type [ptg., pink label] Silvanus granosus ty Grouv/granosus Grouv [both labels in Grouvelle's MS]'. Paralectotypes, 3 ♀♀ with 'Sumatra/Type' as on lectotype. All in MNHN, Paris, but Grouvelle in his original description states 'Sumatra (Deli). Collection Grouvelle. Engano (Bua-Bua). E. Modigliani. Collection du Musee Civique de Genes'; thus other paralectotypes should be in Genoa, Italy.

COMPARATIVE NOTES. See *fasciatus* for characters distinguishing it from this species. The form of the anterior angles of the pronotum, the dull general appearance and the almost complete median line on the metasternum distinguish *granosus* from the other three species in the genus.

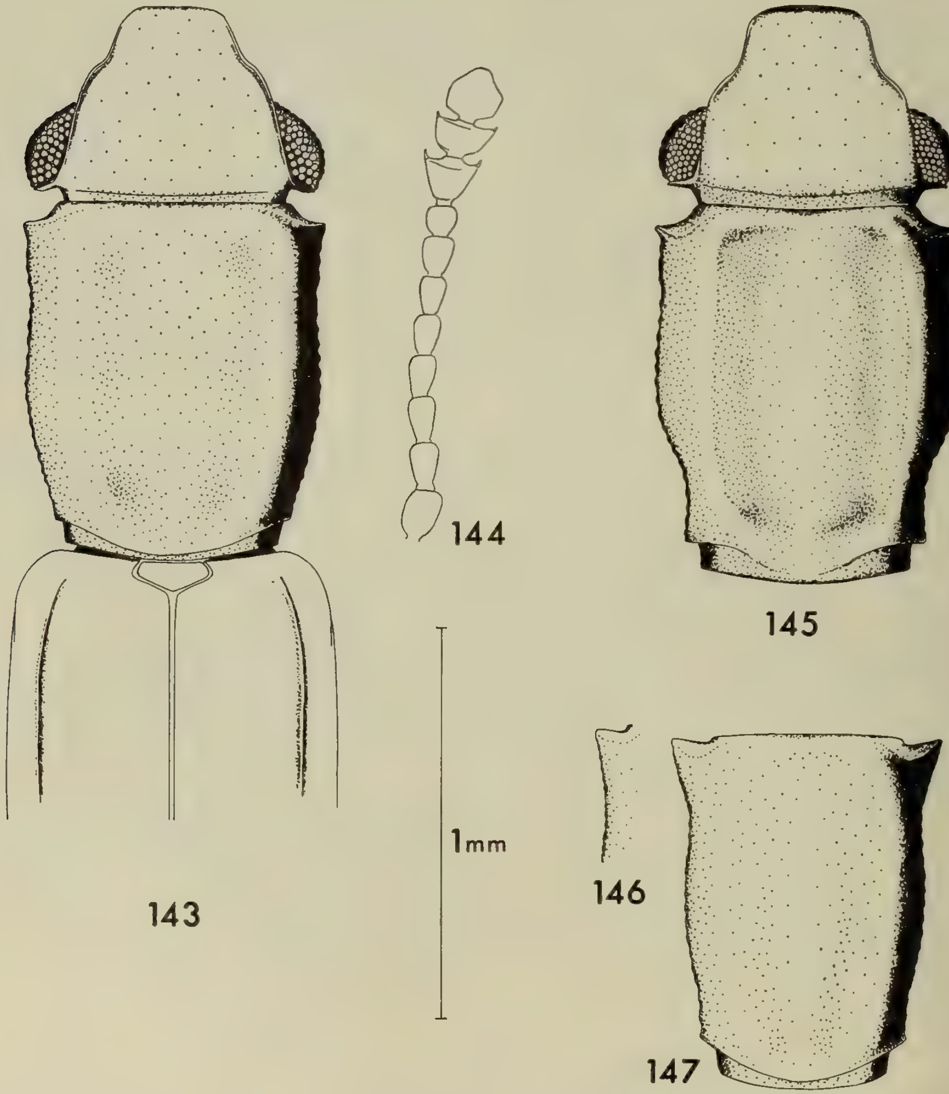
DISTRIBUTION: Oriental. CEYLON: Kandy and Nawalapitiya; MALAYA: 16 mls NE of Kuala Lumpur; SINGAPORE; SUMATRA: Mentawei (and type-localities) and Nias Is; JAVA: Buitenzorg; PHILIPPINES: Binaluan, Luzon and Palawan; N. MOLUCCAS: Ternate; SOLOMON IS: Guadalcanal and Malaita. In BMNH, London; MNHN, Paris; USNM, Washington and ZM, Berlin.

HABITAT. Under bark of dead branch of *Ficus* (Java).

## ***Protosilvanus carinatus*** (Grouvelle)

*Silvanus* (*Protosilvanus*) *carinatus* Grouvelle, 1912 : 336. LECTOTYPE ♂ (here designated, see below), (MNHN, Paris) [examined].

Length 3·11–3·57 mm. Moderately shining, puncturation similar to *lateritius*. *Head* broader than long (13·9–14·1 : 10), slightly broader across eyes than pronotum across anterior angles (10·3–10·4 : 10). *Pronotum*, shape as in *lateritius* but disc with broad longitudinal depressions deeper and a more obvious ridge between them; longer than broad (14·2–14·4 : 10). *Thoracic sternites.* Pro- and mesosternum similar to *lateritius;* metasternal disc slightly depressed on either side of median line which is ill-defined on basal half. *Elytra* 2·81–2·88 times as long as broad, shining; interstria 7 carinate to near apex and 3 carinate for at least basal three-quarters, 5 slightly raised at base. *Abdominal sternites* in ♀ simple, in ♂ 1 may have a very weak median prominence, 2 has a slightly more distinct micro-tubercle, 3 a small median



FIGS 143–147. *Protosilvanus.* 143–144, *P. lateritius* (Reitter). 143, Head, pronotum and base of elytra. 144, Antenna. 145, *P. inaequalis* (Grouvelle) head and pronotum. 146–147, *P. granosus* (Grouvelle). 146, Variant of anterior angle of pronotum. 147, pronotum.

somewhat carinate tubercle, 4 may have a median micro-tubercle. *Legs* in ♂, metatrochanter with a prominent spine on inner apex, metatibia with a tooth on posterior margin near apex. In ♀ legs simple.

Number seen: 5.

Lectotype, present designation, ♂ with 'Sumatra Palembang [Grouvelle's MS – violet ink]/Type [ptg., pink label]/carinatus Grouv [Grouvelle's MS]'. Paralectotypes, 2 ♂♂ with same locality data and type labels as lectotype and 1 ♂ with 'Singapore Raffray [MS]/Type [ptg., pink label]'. All in MNHN, Paris.

In addition to the above I have seen 1 ♀ from Sumatra in Grouvelle's collection (MNHN, Paris).

COMPARATIVE NOTES. The carinate interstriae 3 and 7 distinguish this species.

DISTRIBUTION: Oriental. SUMATRA and SINGAPORE.

### ***Protosilvanus inaequalis*** (Grouvelle)

(Text-fig. 145)

*Silvanus inaequalis* Grouvelle, 1882 : 293. LECTOTYPE ♀ (here designated, see below), NEW CALEDONIA (MNHN, Paris) [examined].
*Silvanus* (*Protosilvanus*) *inaequalis* Grouvelle, 1912 : 336.

Length 3·62 mm. Shining, pubescence sparse. *Head* (Text-fig. 145) broader than long (14·5 : 10); clypeus and frontal triangle, which extends to back of vertex, with punctures as long as one half of eye-facet diameter, and separated by 3–5 times their length, also some minute punctures scattered amongst them, all punctures bearing fine setae (length about twice eye-facet diameter); towards sides of head, punctures becoming large and ocellate (breadth including margin equal to slightly more than that of an eye-facet) and separated by a puncture diameter (including margin) or less; head across eyes slightly narrower than pronotum across anterior angles (10 : 10·2). *Pronotum* (Text-fig. 145) longer than broad (12·6 : 10); disc with broad longitudinal depressions; puncturation on apical half of depressions and median raised region sparse, as on vertex of head, rest of puncturation ocellate as on sides of head; anterior angles little developed. *Thoracic sternites.* Prosternum with apical one-eighth raised and impunctate (except for marginal row of setiferous punctures), then with a broad band of strong transverse rugosity covering rest of apical third, prosternal process with a deep sulcus behind broad apical margin which is strongly rugose; mesosternum shining and deeply depressed; median line of metasternum becoming ill-defined on basal fourth. *Elytra* 2·55 times as long as broad, shining; strial punctures separated by a diameter or less, and interstriae as broad as strial punctures; interstria 7 carinate, interstria 1 slightly raised and producing sutural margin, all other interstriae more or less flat, interstriae, 1, 3, 5 and 7 each with a single row of setiferous punctures, which are ocellate at the basal fifth but soon become very small and lose raised rims, alternate interstriae with more irregular row of setiferous punctures, confused by those on interspaces (one on each interspace) which tend to be close to these interstriae.

Number seen: 1.

Grouvelle (1883) in his description states 'Nouvelle Calédonie. Coll. Grouvelle et Gambey', suggesting that he had more than one specimen before him. There is only one specimen in MNHN, Paris.

Lectotype, present designation, ♀ with 'Nlle Caledonie Montrouzier [MS]/Type [ptg.]/inaequalis A. Grouv [MS]/inaequalis Grouv [MS]'.

Comparative notes. Closely related to *lateritius* Reitter but easily distinguished by the puncturation of the head and prothorax and the sparse pubescence.

Distribution. New Caledonia; in addition to the above localities, the 'Ile des Pins' and 'Coulée Boulari' are recorded by Fauvel (1903).

### ***Protosilvanus lateritius*** (Reitter)

(Text-figs 133–136, 143, 144)

*Silvanus lateritius* Reitter, 1879 : 194. Type(s), Ceylon [not seen, not in TM, Budapest].
*Silvanus* (*Protosilvanus*) *lateritius* Reitter; Grouvelle, 1912 : 336.

Length 2·61–4·23 mm. Moderately shining, pubescence obvious. *Head* broader than long (13·4–14·6 : 10); puncturation variable, particularly dense in specimens seen from Vietnam and Malaya, clypeus comparatively sparsely punctured, rest of head with coarse deep punctures, as broad as an eye-facet (separated by 1–2 diameters in front of vertex and by less than a diameter, elsewhere) and smaller setiferous punctures usually ocellate throughout, always ocellate at sides of head, setae about twice an eye-facet diameter; head across eyes very slightly narrower than pronotum across anterior angles (10 : 10·3–10·5). *Antenna*, Text-fig. 144. *Pronotum* (Text-fig. 143) longer than broad (12·7–14·1 : 10); puncturation similar to that on sides of head, everywhere dense; sides may be slightly more convergent or parallel than in Text-fig. 143; anterior angles little developed; disc with very shallow broad longitudinal depressions, mid-line raised. *Thoracic sternites.* Prosternum without strong transverse rugosity on apical third, although weak rugosity may be present, apical one-eighth raised and with sparse puncturation in addition to marginal row of punctures; prosternal process shallowly depressed behind apical margin, margin coarsely punctured, sometimes slightly rugose; mesosternum moderately shining to dull, more or less flat; metasternal disc flat, median line ill-defined or absent on basal 1/2. *Elytra* 2·38–2·76 times as long as broad (particularly elongate in large specimens), shining; puncturation as in *inaequalis* but interstrial punctures of apical fifth not very obviously ocellate and of similar size along length of interstriae, interstriae 3 and 5 slightly raised at base, 7 carinate to apex, other interstriae more or less flat. *Legs.* In ♂, metatrochanter with a prominent spine on inner apex, meso- and metatibia with a very small tooth near apex of posterior margin, sometimes absent or ill-defined on one pair. In ♀, legs simple. *Genitalia* ♂, Text-figs 134–136, sternites 8 and 9, Text-fig. 133.
Number seen: 120.

Comparative notes. Similar to *inaequalis* but easily distinguished as described under that species. Small specimens resemble *granosus* but the more strongly carinate interstria 7 and general shining appearance are diagnostic for *lateritius*.

Distribution. Oriental. Previously recorded localities (Hetschko, 1930): India, Ceylon, Burma, Andaman Is, Vietnam, Malaya, Singapore, Sumatra, Taiwan, Japan. During the present study specimens have been seen from all recorded localities except Sumatra and in addition from Nepal: nr. Hitaura; Bangladesh: Harbang forest nr. Chiringa; Thailand: Doi Suntep east slope and Khao-Yai National Park; China: Hainan Is, Dwa Bi and N. Kwangtung Lung-Tau-Shan; Philippines: Luzon. In BMNH, London; CAS, California; MF, Munich; TM, Budapest and USNM, Washington.

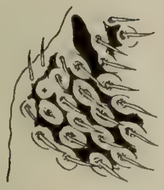
Habitats. Found under bark of *Holotelea integrifolia* (India), on *Albizzia* log (Malaya), collected in a light trap (Singapore), and imported on Burmese groundnut cake loaded at Rangoon.

## ***PARASILVANUS*** Grouvelle **stat. n.**

*Silvanus* (*Parasilvanus*) Grouvelle, 1912 : 335. Type-species: *Silvanus ocellatus* Grouvelle, by PRESENT DESIGNATION.

Number of species: 6.

Length 2·49–4·81 mm; depressed, moderately to extremely elongate; yellowish brown to black with fine decumbent golden pubescence. *Head* transverse to elongate, rather sparsely to densely punctured on frontal triangle, puncturation ocellate, granulate or reticulate; clypeal margin slightly emarginate, with a fine ridge bordering side of clypeus and part of gena and a fovea at clypeogenal emargination (except in *fairmairei*); genae not strongly raised. *Antennae* (Text-figs 166–169, 176) 11-segmented, scape broader than segments 2–6, as broad as or broader than segment 7, segment 8 strongly differentiated from other segments, being much smaller;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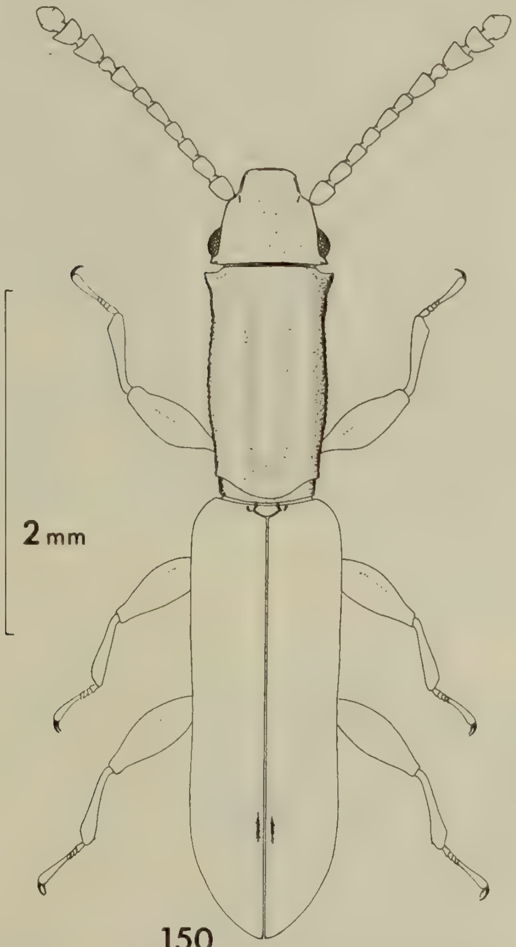

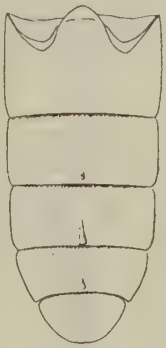
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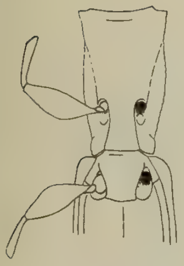
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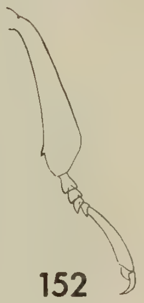
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FIGS 148–152. *Parasilvanus ocellatus* (Grouvelle). 148, Puncturation in region of clypeogenal emargination. 149, Pro- and meso-sternum. 150, Dorsal view of ♂. 151, Abdominal sternites of ♂. 152, Hind leg of ♂.

segments 9 and 10 broader than other flagellar segments and with apical segment forming a loose club, apical margins of club segments with inconspicuous spines. *Eye* small when compared with *Protosilvanus* and not very prominent; temples short (as long as 1·5 eye-facets in *mimosae*) to long (as long as 2–4 eye-facets in *fairmairei*). *Mouth parts*, labial palps with apical segment smaller than penultimate (Text-fig. 131); maxillary palps with segment 2 larger than apical segment (Text-fig. 132). *Thorax* with pronotum moderately to extremely elongate (2·5 times as long as broad), puncturation as on head; anterior margin almost straight to slightly emarginate medially, rim of foramen may be considerably in advance of anterior angles (e.g. *pulcher*); anterior angles small, obtuse or acute at apex, variable within species; side margins finely serrate; posterior angles ill-defined to distinct; posterior margin sometimes tending to be confluent with rim of foramen; sides steeply declivous from broad disc, which may be shallowly and broadly depressed on each side or bear deep longitudinal depressions (e.g. Text-figs 150 and 163). *Scutellum* transverse. *Prosternum* (Text-fig. 149) with sternopleural sutures and procoxal cavities as in *Silvanus*, prosternal process with a slight channel, at apex slightly broader than between coxae, in comparison with *Silvanus* only a little broader apically than mesosternal apex. *Metasternum* with median line more or less complete. *Legs* with tarsi as in *Silvanus*, secondary sexual characters exhibited by ♂ as follows: metatrochanter with tooth on inner apex (*mimosae* only); metatibia with lamellate tooth near apex (except in *oblitus*). *Elytra* with 9 rows of punctures forming striae – in *mimosae* a tenth stria present on basal third; all interstriae equally raised (*mimosae*) or with interstria 2 flat, then alternate interstriae raised, in some species 3 and 5 slightly, 7 and 9 forming distinct ridges (carinate), 9 only at base, setiferous punctures of interstriae and interspaces may be ocellate; in ♂ *tenuis*, *ocellatus*, *pulcher* sutural stria depressed near apical fourth for distance of 4 or 5 punctures and tip of elytra may be slightly flexed dorsally (characters ill-defined or absent in small specimens); elytra not explanate at sides; epipleura not quite as broad as in *Silvanus*, tapered to apex or just before apex. *Wing* as in *Silvanus*. *Metendosternite* without a stem. *First visible sternite of abdomen* 'sternite 1' with femoral lines closed; in ♂ sternite 3 may have a carinate process medially towards caudal margin (Text-fig. 151), 2 and 4 may have a microtubercle in same position and 4 a small carinate process; in small ♂♂ these processes are small or absent. *Genitalia*, ovipositor similar to *Silvanus*; aedeagus with median strut variable, similar to *mimosae* (Text-fig. 153) or broader (*fairmairei*), parameres truncate or rounded at apex, bearing from 2 to approximately 14 long setae, median lobe with apex produced (Text-figs 156–162), internal sac with complex chitinous structure as in *mimosae* (Text-fig. 154) or shorter, e.g. in *fairmairei* and *tenuis*; ♂ abdominal sternites 8 and 9 similar to Text-fig. 155.

DISTRIBUTION. Ethiopian.

### KEY TO SPECIES OF *PARASILVANUS*

1 Head and pronotum punctate-reticulate (Text-fig. 178); elytra punctate-striate, all interstriae equally raised (Text-fig. 179); head and pronotum as in Text-figs 174, 175 . . . . . . . . . **mimosae** sp. n. (p. 107)

– Head and pronotum not punctate-reticulate, either interspaces much broader or puncturation entirely different; elytra different; head and pronotum not as above . . . . . . . . . . . . . . . 2

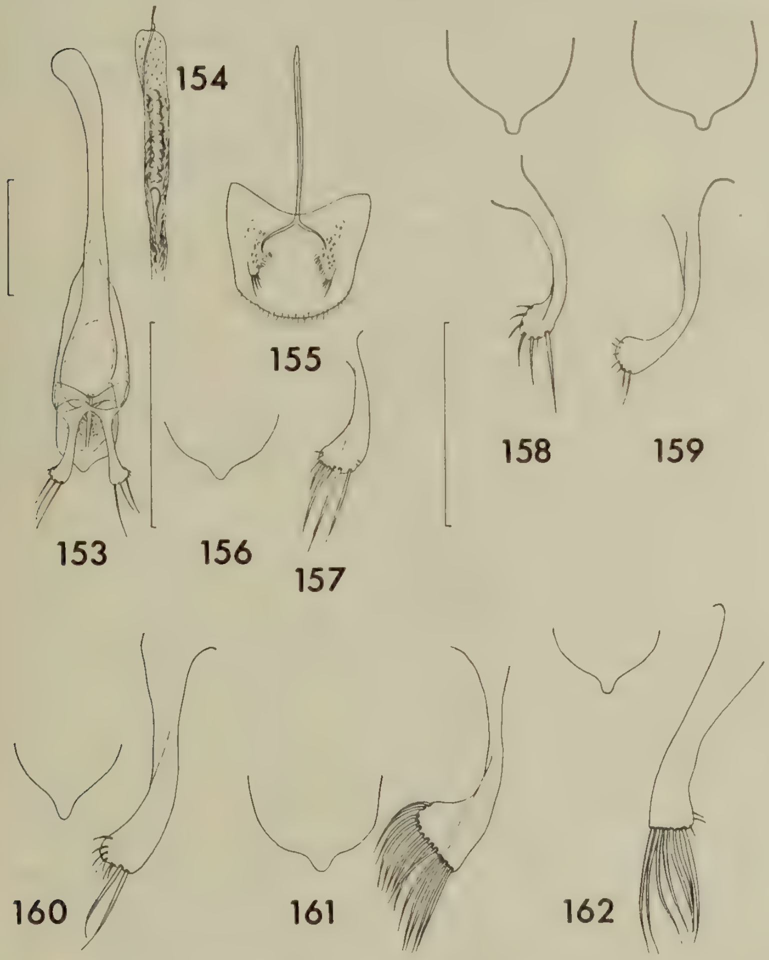
2 (1) Head appearing finely granulate due to densely reticulate interspaces, clypeus and frontal triangle with sparse puncturation (Text-fig. 170) different from that near eyes; without a fovea at clypeogenal emargination; 8th antennal segment as in Text-fig. 169; form of head and pronotum characteristic (Text-figs 172, 173) . . . . . . . **fairmairei** (Grouvelle) (p. 100)

Head not appearing finely granulate, puncturation of frontal triangle not obviously different from that of rest of head; with a fovea at clypeogenal emargination; antennae as in Text-figs 166–168; pronotum moderately to extremely elongate . . . . . . . . . . . 3

3 (2) Extremely elongate species; form of head and pronotum diagnostic, pronotum behind anterior angles, broadest at basal third (Text-fig. 163). Length 3·42–4·81 mm . . . . . **pulcher** (Grouvelle) (p. 102)

– Moderately elongate species; pronotum and head not as above, pronotum behind anterior angles, broadest at middle . . . . . . . . . 4

4 (3) Vertex of head with deep, obvious coarse punctures and fine setiferous punctures with slightly raised margins (slightly ocellate) Text-fig. 171; head slightly longer than broad (10·4–11 : 10); pronotum elongate (18–19 : 10), disc without obvious foveae (slight depressions are present) Text-fig. 164 **tenuis** (Grouvelle) (p. 103)



FIGS 153–162. *Parasilvanus*, male genitalia. 153–157, *P. mimosae* sp. n. 154, Internal sac. 155, Sternites 8 and 9. 156, Apex of median lobe. 157, Paramere. 158–162, Apex of median lobe and paramere. 158, *P. fairmairei* (Grouvelle). 159, *P. tenuis* (Grouvelle). 160, *P. ocellatus* (Grouvelle). 161, *P. oblitus* (Grouvelle). 162, *P. pulcher* (Grouvelle). Scale lines = 0·2 mm.

– Vertex of head with ocellate setiferous punctures dominant, coarse punctures present but less obvious; pronotal length : breadth 15–19 : 10, disc with shallow to deep lateral foveae, if with shallow foveae then head broader than long (11–12 : 10) . . . . . . . . . . . . 5

5 (4) Pronotum more elongate (16–19 : 10) with deep lateral foveae on disc; head often appearing elongate, although broader than long (10·1–10·4 : 10), Text-fig. 150; metasternal disc with well-defined lateral depressions and comparatively impunctate regions of caudal half obvious (only fine setiferous punctures present), interspaces dull to moderately shining; in ♂, metatibia with a lamellate tooth towards apex (Text-fig. 152) and elytra with sutural stria depressed near apical fourth (Text-fig. 150) . . . ***ocellatus*** (Grouvelle) (p. 104)

– Pronotum less elongate (15–16 : 10) with shallow ill-defined lateral depressions on disc; head more obviously broader than long (11–12 : 10), Text-fig. 165; metasternal disc without distinct lateral depressions hence impunctate regions (as above) ill-defined, interspaces shining; in ♂, sutural stria of elytra and metatibia simple . . . . . . . ***oblitus*** (Grouvelle) (p. 105)

## ***Parasilvanus fairmairei*** (Grouvelle)

(Text-figs 158, 169, 170, 172, 173)

*Silvanus fairmairei* Grouvelle, 1882 : 292. Type(s), ZANZIBAR [not seen].
? *Silvanus filum* Kraatz, 1895 : 162. Holotype, sex indet., TOGO [not seen, synonymy Grouvelle's (1912) suggestion].
*Silvanus* (*Parasilvanus*) *fairmairei* Grouvelle, 1912 : 335.

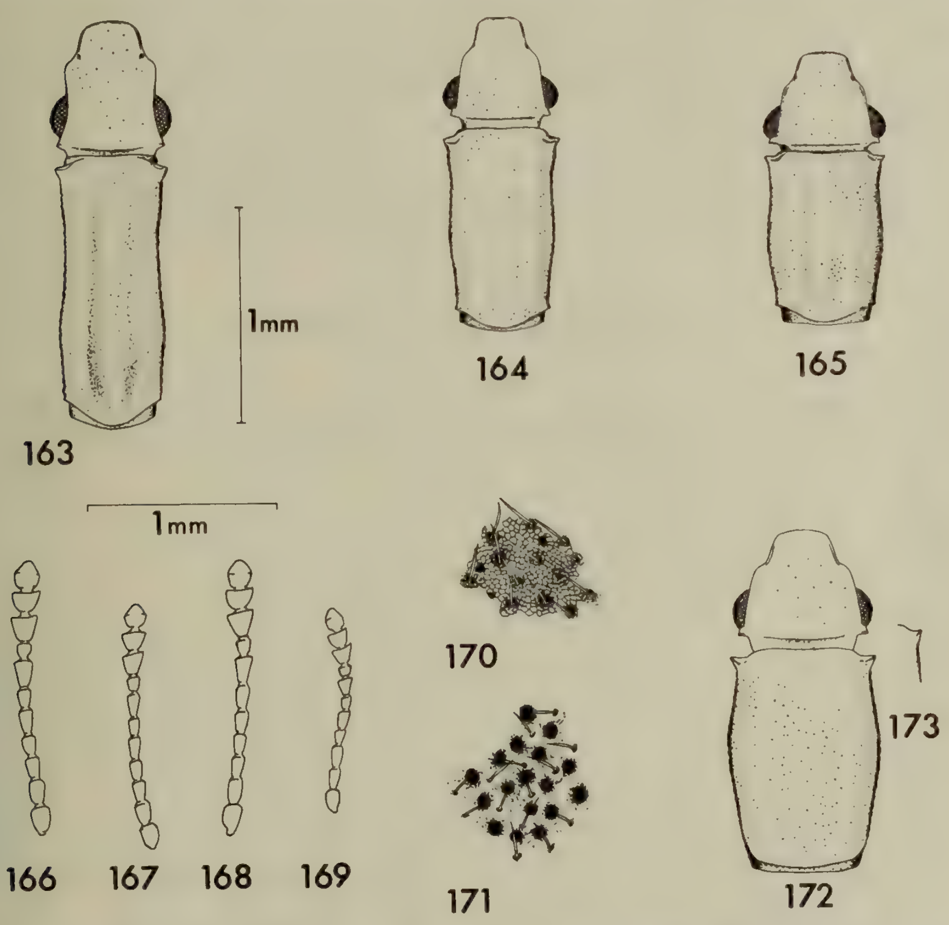
Length 3·08–4·14 mm. Black or brown. *Head* broader than long (12–13 : 10), clypeus and frontal triangle which extend to middle of vertex, sparsely punctured having setiferous punctures (diameter, one half to one third of eye-facet) separated by 2–4 diameters, rest of head with slightly rugose puncturation, everywhere interspaces strongly reticulate (Text-fig. 170), appearing finely granulate and dull except on clypeus where moderately shining; clypeus without a fovea at clypeogenal emargination; ventral puncturation similar to that on sides of vertex. *Antenna*. Text-fig. 169, slightly longer than pronotum (11 : 10) 8th segment slightly transverse. *Pronotum* 1·5–1·6 times as long as broad, breadth across anterior angles slightly greater than across eyes (10·6–10·7 : 10), Text-fig. 172; puncturation similar to that at sides of vertex (when viewed at certain angles may appear somewhat ocellate), interspaces strongly reticulate and dull; anterior angles variable – forms illustrated in Text-figs 172, 173; disc with broad shallow depressed areas each side of mid-line; basal margin not confluent with rim of foramen which is higher than it. *Thoracic sternites*. Prosternum with a distinct striga across apical ninth and some feeble transverse rugosity from apical one third to one ninth, punctures shallow and ill-defined, towards sides appearing granulate, interspaces strongly reticulate and dull; mesosternum and metasternum everywhere strongly reticulate and dull, bearing shallow punctures separated by 1–2 diameters, but becoming denser and larger towards base of mesosternum and sides of metasternum. *Elytra* 2·9–3·1 times as long as broad, general shape as in *ocellatus*, striae and interstriae as in *tenuis* but ♂ without a depression near apex and setiferous punctures sometimes ocellate. *Abdominal sternites*. Puncturation fairly dense, shallow setiferous punctures separated by less than half a diameter; in ♀ discs of sternites not depressed, in small ♂♂, discs of sternites similarly not depressed but with a tubercle medially near caudal margin on sternite 3; in large ♂♂, disc of sternite 1 almost flat, sternites 2–5 with disc depressed, sternite 3 with a carinate process and 4 with a micro-tubercle medially towards caudal margins. *Legs*. Metatibia in ♂ with a lamellate tooth near apex (as in *ocellatus*). *Genitalia* ♂, apex of median lobe and paramere, Text-fig. 158, median strut broad, more as in *Protosilvanus lateritius* – Text-fig. 134.

Number seen: 500+.

Although the types of *fairmairei* have not been located, a number of specimens determined by Grouvelle (in MNHN, Paris and MRAC, Tervuren) have been examined. Grouvelle (1912) thought that *Silvanus filum* Kraatz was probably a variety of *fairmairei*. The type of *filum* has not been found. Specimens in the Deutsches Entomologisches Institut labelled *filum* by Kessel are *fairmairei*.

Comparative notes. The puncturation of the head and the general facies of this species are distinctive.

Distribution. Ethiopian, sometimes imported with timber (to Italy and Britain) and one record in association with stored products. Mauritania: Bafrechie



Figs 163–173. *Parasilvanus*. 163, *P. pulcher* (Grouvelle) head and pronotum. 164, *P. tenuis* (Grouvelle) same. 165, *P. oblitus* (Grouvelle) same. 166–169, Antennae. 166, *P. ocellatus* (Grouvelle). 167, *P. tenuis*. 168, *P. oblitus*. 169, *P. fairmairei* (Grouvelle). 170–171, Puncturation on vertex. 170, *P. fairmairei*. 171, *P. tenuis*. 172–173, *P. fairmairei*. 172, Head and pronotum. 173, Variant of anterior angle of pronotum.

and Misserah; SENEGAL: Badoumbe and Linguere; SIERRA LEONE: Njala; GUINEA: Region Kindia and N'Zérékoré and Mt Nimba; LIBERIA: Voinjama; GHANA: widely distributed; TOGO: Bismarkburg; NIGERIA: Ile-Ife, Zaria, Kano, Oyo, Isheri and Ibadan; IVORY COAST: Tonkoui and 5 ml ESE of Touba; CAMEROUN: Japoma, Mabete, Victoria, N'Kongsamba, N'Goko, Abong-Mbong and YaDande; EQUATORIAL GUINEA: N'Kolentangan; ZAIRE: widely distributed (reference numbers of specimens collected in the Parc National de la Garamba (see p. 43) 928, 985, 1214, 2115, 2298, 2601, 3276, 3384, 3519, 3563, 3738, 3744, 3748, 3757, 3799, 3992, 4007); ANGOLA: Cazombo, Mabete, 10 ml NE of Sada Bandeira and 6 ml NW of Sta Comba Dao; UGANDA: Kampala, Jinja and Sasse Islands; TANZANIA: 15 mls S of Handeni and 14 mls S of Sumbawanga; KENYA: Tiwi and Gazi (Grouvelle, 1923); MOZAMBIQUE: Caia; ZAMBIA: Mwengwa and Shigariatombwes; RHODESIA: Salisbury and 2 ml NW of Sinola. In BMNH, London; CAS, California; IFAN, Dakar; IRSNB, Brussels; MNHN, Paris; MRAC, Tervuren; TM, Budapest and ZM, Berlin.

HABITATS. This species has been collected at light (Ghana, Nigeria and Zaire), under bark of dead trees and shrubs (*Ricinodendron*, *Canarium*, *Erythrophloeum*, *Chlorophora* etc.), in humus and alighting on fruits of *Ficus capensis*.

## ***Parasilvanus pulcher*** (Grouvelle)

(Text-figs 162, 163)

*Silvanus pulcher* Grouvelle, 1905 : 255. LECTOTYPE ♀ (here designated, see below), EQUATORIAL GUINEA (Instituto Español de Entomología, Madrid) [examined].
*Silvanus* (*Parasilvanus*) *pulcher* Grouvelle, 1919 : 206.

Length 3·42–4·81. Large specimens extremely elongate. *Head*. Form characteristic (Text-fig. 163), longer than broad (comparatively longer in largest specimens) 11–13 : 10, with coarse deep punctures (diameter, equal to or less than eye-facet) and on interspaces ocellate setiferous punctures (diameter, one half to one third of coarse punctures), interspaces reticulate and moderately shining; clypeus with a fovea at clypeogenal emargination; ventral surface with coarse deep punctures, and fine setiferous punctures on narrow, shining interspaces (setiferous punctures may be somewhat ocellate), reticulation feeble. *Antennae* similar to *tenuis*, longer than prothorax (13–14 : 10). *Pronotum* 2·2–2·5 times as long as broad, breadth across anterior angles slightly to distinctly less than across eyes (10 : 10·6–11·7), behind anterior angles narrowest at apical third and broadest at basal third (Text-fig. 163); puncturation similar to that on head; anterior angles distinctly lateral; disc with longitudinal depressions as in *ocellatus*; basal margin higher than rim of foramen, not confluent with it. *Thoracic sternites*. Prosternum with slight transverse rugosity towards apical ninth, pro- and mesosternal puncturation rather rugose, coarse punctures (twice eye-facet diameter) and fine setiferous punctures on interspaces, some, particularly on prosternal process, appearing slightly ocellate, interspaces narrow strongly reticulate and dull; metasternum as in *ocellatus*. *Elytra* 2·6–3·1 times as long as broad, general facies as in *ocellatus*, ♂ with an elongate fovea on sutural stria and elytra slightly flexed dorsally at apex, both characters ill-defined or absent in very small specimens, ♀ simple. *Abdominal sternites* with coarse punctures separated by 1–2 diameters on disc and becoming larger and denser towards sides, interspaces with fine setiferous punctures; in ♀♀, discs of sternites not depressed and without tubercles, in small ♂♂, disc of sternite 1 flat, extremely feeble depressions on sternites 2–4, sternite 5 depressed; in large ♂♂, deeper depressions, particularly deep on sternite 2; ♂ sternite 3 with a carinate tubercle medially near caudal margin (as in *ocellatus*, Text-fig. 151) and sternites 2 and 4 with hardly discernible micro-tubercles in the same position. *Metatibia* in ♂ with a lamellate tooth. *Genitalia* ♂, apex of median lobe and paramere, Text-fig. 162.

Number seen: 37.

Grouvelle described this species twice (Grouvelle, 1905 and 1919). In the paper containing the original description (Grouvelle, 1905) he states 'Les insectes objet de ce Mémoire provenant sans exception de Biafra – Cabo San Juan, et ayant été recueillis par M. Martinez de la Escalera . . .' and thus only specimens bearing this locality data can be considered as types. There are two specimens in the MNHN, Paris, from Cameroun (*Kraatz*) labelled 'Type [ptg] Silvanus pulcher Grouv [Grouvelle's MS]' but these obviously cannot be types.

Grouvelle gave no indication of the number of specimens on which he based his original description.

Lectotype, present designation, ♀, length 3·5 mm, with 'Biafra Cabo S. Juan VII–1901 Escalera [ptg.]/19/Silvanus pulcher Grouv [Grouvelle's MS]', in Instituto Español de Entomología, Madrid.

COMPARATIVE NOTES. Closely related to *ocellatus* but the shape of the head and pronotum is diagnostic.

DISTRIBUTION. Ethiopian. GHANA: Bobiri forest res., and Kumasi; CAMEROUN: Joh-Albrechtshöhe and Mabete; EQUATORIAL GUINEA (type-locality): Fernando Po Is (in Instituto Español de Entomología, Madrid) and Makomo Campogbt; GABON; ZAIRE: Haut-Vele, Bas-Vele, Equateur, Kasal, Jadolville and 39 km S of Walikale; CONGO: Brazzaville. In BMNH, London; CAS, California; MNHN, Paris; MRAC, Tervuren; TM, Budapest and ZM, Berlin.

HABITATS. In Ghana it has been collected on dead and fallen trees and at light.

## ***Parasilvanus tenuis*** (Grouvelle)

(Text-figs 159, 164, 167, 171.)

*Silvanus tenuis* Grouvelle, 1889 : 105. LECTOTYPE ♂ (here designated, see below), IVORY COAST (MNHN, Paris) [examined].

*Silvanus* (*Parasilvanus*) *tenuis* Grouvelle, 1912 : 335.

Length 2·97–3·91 mm. *Head* slightly longer than broad (10·4–11 : 10), vertex with coarse, deep punctures as broad as an eye-facet, in general separated by less than a diameter, interspaces shining and bearing fine setiferous punctures which have slightly raised margins (somewhat ocellate) Text-fig. 171; clypeus with a small deep fovea at clypeogenal emargination; ventral puncturation similar to that on vertex. *Antennae* (Text-fig. 167) longer than pronotum (13 : 10) 8th segment a little longer than broad (11 : 10). *Pronotum.* Almost twice as long as broad (18–19 : 10), breadth across anterior angles equal to that across eyes; puncturation as on vertex; form as in Text-fig. 164, disc nearly flat (extremely shallow, ill-defined depressions each side of mid-line); basal margin not confluent with rim of foramen. *Thoracic sternites.* Pro- and mesosternal puncturation as on ventral region of head, interspaces shining and with ill-defined reticulation, prosternum with feeble transverse rugosity towards apex (as in *ocellatus*); metasternum with broad, shallow, punctate depressions each side of caudal half of median line, which is situated in a narrow shining impunctate region (breadth of 2–3 coarse punctures).

*Elytra* 2·7–2·8 times as long as broad, sides subparallel to apical fourth, then moderately convergent, finally rounded to apex; punctate-striate, strial punctures coarse and deep, separated longitudinally by half diameter or less; ♂ sutural stria depressed near apical fourth for distance of 4–5 punctures; interstriae and sides of strial interspaces bearing fine setiferous punctures; interstria 2 flat (interstria 1 = sutural interstria) then alternate interstriae raised, interstriae 3 and 5 slightly raised, 7 and 9 forming low ridges, 7 for greater part of length, 9 basally. *Abdominal sternites.* Puncturation similar to thoracic sternites but less dense on sternites 2–5 and interspaces more obviously reticulate, shining; in ♀♀, discs of sternites flat; in ♂♂, discs of sternites 2–5 slightly depressed (in large ♂♂ sternite 4 with deepest depression), sternite 2 with a micro-tubercle medially near caudal margin and, in a similar position, on sternite 3 a carinate tubercle. *Legs.* Metatibia of ♂ with a lamellate tooth towards apex (as illustrated in Text-fig. 152). *Genitalia* ♂, apex of median lobe and paramere, Text-fig. 159.

Number seen: 14.

Lectotype, present designation, ♂, length 3·47 mm, with 'Assinie Afrique oc [green label ptg.]/Type/Type [pink and white labels ptg.]/Silvanus tenuis Grouv [MS]/S. tenuis ty. Grouv [Grouvelle's MS]'. Grouvelle (1889) gave no indication of the number of specimens on which he based his description but in a later paper (Grouvelle, 1892) he described *tenuis* thus 'Assinie, commun' and therefore, although I have found only one specimen (in MNHN, Paris) labelled 'Type', I have chosen to designate it as a lectotype.

COMPARATIVE NOTES. The elongate pronotum without distinct longitudinal depressions on the disc (slight depressions are present) and the puncturation of head and pronotum distinguish this species from the closely related *ocellatus* and *pulcher*.

DISTRIBUTION. Ethiopian. SIERRA LEONE: Njala (BMNH, London); IVORY COAST: Lectotype and 9 ex. Tonkoui (IFAN, Dakar) NIGERIA: Ile-Ife (PICL, Slough); CAMEROUN: Matute (CAS, California); EQUATORIAL GUINEA (Grouvelle, 1905, 1919, specimens not seen); ZAIRE: Beni Ituri forest from flower spike of palm (BMNH, London) Equateur Flandria (MRAC, Tervuren).

### ***Parasilvanus ocellatus*** (Grouvelle)

(Text-figs 148–152, 160, 166)

*Silvanus ocellatus* Grouvelle, 1889 : 104. LECTOTYPE ♂ (here designated, see below), IVORY COAST (MNHN, Paris) [examined].

*Silvanus* (*Parasilvanus*) *ocellatus* Grouvelle, 1912 : 335.

Length 3·31–4·03 mm. *Head* about as broad as long (10·1–10·4 : 10) with ocellate setiferous punctures (coarser punctures, e.g. as in *tenuis*, ill-defined) punctures on vertex having diameter (including margin) equal to an eye-facet and separated by a diameter, or less, interspaces dull, only margins of punctures shining; clypeus with a small fovea at clypeogenal emargination (Text-fig. 148); ventral surface with ocellate punctures as on vertex and coarse punctures mostly reduced to crescents. *Antennae* longer than pronotum, longest in large specimens (11–13 : 10), 8th segment almost quadrate, Text-fig. 166. *Pronotum* 1·6–1·9 times as long as broad, breadth across anterior angles equal to, or greater than across eyes (11 : 10); puncturation as on vertex but less dense, punctures separated by 1–2·5 diameters; shape as in Text-fig. 150 or sometimes with sides more convergent from middle to base; disc with two moderately strong, longitudinal depressions which are deepest medially and remain fairly distinct basally; basal margin not confluent with rim of foramen. *Thoracic sternites.* Prosternum with coarse puncturation (laterally punctures with diameter twice that of eye-facet) and ocellate setiferous punctures on strongly reticulate, dull to moderately shining interspaces, at apical ninth some punctures laterally confluent, producing feeble transverse rugosity; metasternal disc with distinct shallow lateral foveae bearing coarse punctures and ocellate setiferous punctures, comparatively impunctate at sides for caudal half or two-thirds and along median line (only setiferous punctures present), interspaces everywhere strongly reticulate and dull to moderately shining. *Elytra* 2·7–3·0 times as long as broad, shape as in Text-fig. 150; alternate interstriae (3, 5, 7 and 9) more or less equally raised, striae as in *tenuis* (for ♂ see Text-fig. 150). *Abdominal sternites* with coarse punctures (rather ill-defined laterally in some specimens) and somewhat ocellate setiferous punctures; in ♀♀, discs of sternites simple, in ♂♂ (Text-fig. 151) discs depressed, depressions deepest in largest specimens, sternite 2 with strongest depression, 5 more or less concave; sternite 3 with a distinct carinate process, in *large* ♂♂ sternite 2 with a micro-tubercle and 4 with a small carinate process, in *small* ♂♂ these two sternites bearing ill-defined process. *Legs*. Metatibia in ♂ (Text-fig. 152) with a lamellate tooth towards apex. *Genitalia* ♂, apex of median lobe and paramere, Text-fig. 160.

Number seen: 200.

Lectotype, present designation, ♂, length 3·9 mm, with 'Assinie Côte occid Afrique Ch. Alluaud 1886/Type [both labels ptg.]/S. ocellatus Grouv ty. [Grouvelle's MS]'. Paralectotypes, 2 ♂, one with same locality label as lectotype, the other with 'Abyssinie Raffray [MS]/Type [ptg.]/ocellatus Grouv.'. All in MNHN, Paris.

COMPARATIVE NOTES. This species might be confused with the closely related *oblitus* or *tenuis*. The dominant ocellate puncturation of head and pronotum and the strong longitudinal depressions on the pronotum distinguish *ocellatus* from *tenuis*. See comparative notes under *oblitus* for distinguishing characters.

DISTRIBUTION: Ethiopian. SENEGAL: Mbao; GUINEA: Mt Nimba, Region Kindia and N'Zérékoré; IVORY COAST: (syntypes) and Tonkoui; SIERRA LEONE: Njala; TOGO: Bismarkburg; GHANA: Mpraeso; DAHOMEY: Mt Togo nr Klouto; NIGERIA: Abeokouta and Ile-Ife; CENTRAL ARFICAN REPUBLIC: Fort Crampeli; EQUATORIAL GUINEA: Nkolentangan and Uellenburg; ZAIRE: widely distributed (reference numbers of specimens collected in the Parc National de la Garamba (see p. 43) 985, 1281, 2315, 3082, 3115, 3384, 3649, 3774, 3823, 4007); ANGOLA: Cubal, Dundo and Mabete; ETHIOPIA: (syntypes) and nr Nazareth; UGANDA: Busalamu, Kampala, Maragambo Forest, nr Jinja and Ruwenzori Range, Semliki Forest, 2,850 ft; KENYA: Kaimosi Mission NE of Kisumu; TANZANIA: Lake Manyara and nr Sumbawanga. In BMNH, London; CAS, California; IFAN, Dakar; IRSNB, Brussels; MD, Dundo; MF, Munich; MNHN, Paris, MRAC, Tervuren; TM, Budapest and ZM, Berlin.

HABITATS. In the field this species has been found under bark of dead trees (*Voacanga obtusa*, *Spondianthus preussi*, *Cedrella* and *Hevea*) and at light. It has been found on stored products on one occasion and a specimen was collected in a British timber-yard on an African mahogany log.

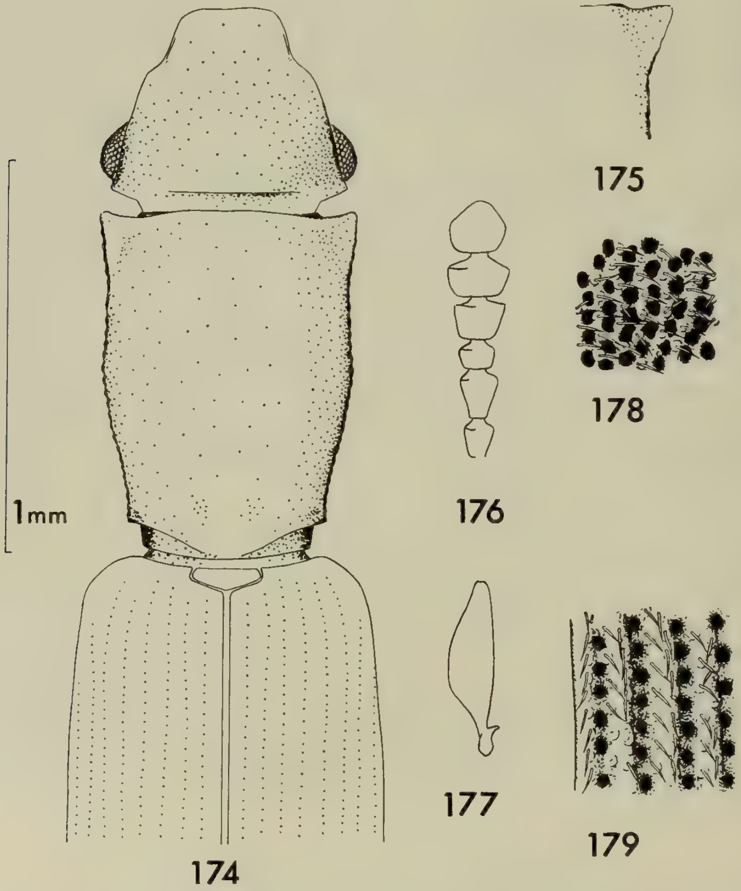
## ***Parasilvanus oblitus*** (Grouvelle)

(Text-figs 161, 165, 168)

*Silvanus oblitus* Grouvelle, 1909 : 116. Holotype ♀, TANZANIA (MNHM, Paris) [examined].
*Silvanus* (*Parasilvanus*) *oblitus* Grouvelle, 1912 : 335.

*Silvanus apicalis* Grouvelle, 1923 : 266. LECTOTYPE ♂ (here designated, see below), KENYA (MNHN, Paris) [examined]. **Syn. n.**

Length 3·25–4·15 mm. *Head* broader than long (11–12 : 10); puncturation variable, ocellate setiferous punctures on interspaces of coarser punctures, the latter slightly broader than an eye-facet and in some regions becoming ill-defined, diameter of ocellate puncture, including rim, equal to half that of coarse puncture; interspaces dull when compared with shining margins of ocellate punctures; clypeus with a small fovea at clypeogenal emargination; ventral puncturation coarse and dense, most of punctures larger than eye-facets, interspaces with fine setiferous punctures, shining. *Antennae* (Text-fig. 168) longer than pronotum (14 : 10), segments slightly more elongate in largest specimens, 8th segment as long as, or slightly longer than broad. *Pronotum* (Text-fig. 165) 1·5–1·6 times as long as broad, breadth across anterior angles greater than across eyes (11 : 10); puncturation similar to vertex; disc with two shallow ill-defined longitudinal depressed areas which merge and become diffuse basally; basal margin not confluent with rim of foramen. *Thoracic sternites* with dense coarse puncturation, largest punctures



FIGS 174–179. *Parasilvanus mimosae* sp. n. 174, Head, pronotum and base of elytra. 175, Variant of anterior angle of pronotum. 176, Antennal segments 6–11. 177, Metatrochanter and femur of ♂. 178, Puncturation of pronotum. 179, Puncturation of elytra (small area including sutural margin).

twice as broad as an eye-facet, very fine setiferous punctures on shining interspaces; prosternum with transverse feeble rugosity towards apex (as in *ocellatus*); metasternal disc depressed, shining, reticulation ill-defined to distinct, sparsely punctured with fine setiferous punctures and coarse punctures, without distinct lateral depressions although lateral and median regions without coarse punctures. *Elytra* 2·8 times as long as broad; similar to *tenuis* but ♂ elytra without a short depressed area on sutural stria. *Abdominal sternites* with puncturation coarse and rather shallow, particularly on sternites 1 and 2, punctures becoming larger laterally where separated by less than diameter, medially separated by 1–2 diameters; interspaces with extremely fine punctures (non ocellate), reticulation ill- to well-defined; in ♀♀ discs of sternites not depressed, in ♂♂ disc of sternite 1 flat, 2 slightly to strongly (large specimen) depressed and with a small more of less distinct tubercle medially near caudal margin, 3 slightly depressed, bearing a prominent carinate process in the same position, 4 also slightly depressed and with a tubercle as in 2, 5 whole sternite concave. *Legs*. Tibia simple in both sexes. *Genitalia* ♂, apex of median lobe and paramere, Text-fig. 161.

Number seen: 23.

Holotype ♀, length 3·42 mm, with 'Af. or All Dar es Salaam [MS]/Eichelbaum [MS]/Type [MS violet ink]/12q/Type [pink label ptg.]/S. oblitus ty Grouv [green label Grouvelle's MS]'. In MNHN, Paris; unique.

There are four syntypes of *S. apicalis* Grouvelle in MNHN, Paris, with data as given in the original description.

Lectotype, present designation, ♂, length 3·47 mm, with 'AFR. OR. ANGL (KIKUYU-ESCT) KIJABE ALLUAUD ET JEANNEL Dec 1911– 2100 m – St 27./Type [pink label ptg.]/apicalis Grouv [green label Grouvelle's MS]'. Paralectotypes, one with locality label as lectotype, others with 'Afrique orient. anglaise FORET DE NAIROBI ALLUAUD & JEANNEL Nov.–Dec. 1911 – 1700 m – St 28/Type [pink label ptg.]/Silvanus apicalis Grouv [Grouvelle's MS]'.

COMPARATIVE NOTES. The comparatively short pronotum with shallow longitudinal depressions which merge basally, the shining metasternum bearing a few coarse punctures, the more transverse head with less elongate clypeogenal foveae and the parameres distinguish this species from the very closely related *ocellatus*.

DISTRIBUTION: Ethiopian. ZAIRE: Ituri; ANGOLA: Cuito, 14 ml SE of Hengue and nr source of R. Tchimboma; SUDAN: Didinga Distr.; KENYA: Kitale, Kijabe, Nairobi and Ambony River (Grouvelle, 1923 *oblitus* and *apicalis*); TANZANIA: Dar es Salaam (holotype); RHODESIA: Mashonaland; SOUTH AFRICA: St Lucia, Malvern and Pretoria. In BMNH, London; CAS, California; MNHN, Paris and MRAC, Tervuren.

HABITATS. It has been found with *Lyctus brunneus* (Pretoria) and collected on *Cedrella* (Ituri) and under bark of *Eucalyptus* etc. (Angola).

### *Parasilvanus mimosae* sp. n.

(Text-figs 153–157, 174–179)

Length 2·49–3·39 mm. Puncturation of head, prothorax and elytra similar (Text-figs 178, 179). General appearance rather dull. The Ghanaian specimens are rather atypical, having broader heads, shorter thorax and short elytra, ratios for these are given in square brackets. *Head* broader than long (11·3–11·9 : 10) [12·1–12·8 : 10] punctate-reticulate, having regular deep, dense, coarse puncturation (breadth of puncture equivalent to twice an eye-facet) producing a strong reticulation, interspaces narrow, moderately shining and with fine setiferous punctures (reticulation (micro) of interspaces ill-defined); clypeus with a small fovea at clypeogenal emargination; vertex moderately to strongly raised. *Antennae* (Text-fig. 176), much longer than pronotum (14·5–14·3 : 10) 8th segment transverse. *Pronotum* times 1·38–1·49 [times 1·25–1·33] as long as broad, breadth across anterior angles slightly greater than across eyes (10·7–10·1 : 10); development of anterior angles variable (Figs 174, 175); disc without distinct longitudinal depressions, extremely feebly depressed towards base; medially basal margin almost confluent with rim of foramen. *Metasternum* slightly depressed in the middle of caudal half. *Elytra* 2·4–2·64[2·39–2·5] times as long as broad, striate (Text-fig. 179) and dull; strial punctures coarse and deep, separated longitudinally by one-third diameter or less; interstriae broader than strial punctures; all equally raised, forming rounded ridges and giving the elytra a striate appearance; interstriae bearing fine setiferous punctures. *Abdominal sternites.* Discs of sternites in both sexes without obvious depressions; in ♂♂ discs of sternites 1 and 2 may be extremely feebly depressed, sternite 3 in large ♂♂ with a small median tubercle towards caudal margin, in small ♂♂ this is ill-defined. *Legs.* In ♀ simple. Tibia in ♂ simple but metatrochanter with a tooth on inner apex (Text-fig. 177). *Genitalia* ♂, Text-figs 153–157 (155, sternites 8 and 9).

Holotype ♂, length 2·97 mm, ETHIOPIA: Djem-Djem Forest, circa 8,000 ft, Box 28, 25–29.ix.1926 (*Dr H. Scott*) (BMNH, London).

Paratypes (47). 23 ex. with same data as holotype; 2 ex., Djem-Djem Forest, nearly 9,000 ft. under bark of decaying *Mimosa*, Box 31 (*Dr H. Scott*) (these and the previous 23 ex. in BMNH, London); 6 ex., KENYA: Meru, vii. [19]43 (*van Someren*) (BMNH, London); 2 ex., Kaimosi Mission, 27 ml N.E. of Kisumu, 29.xi.57 (*E. S. Ross and R. E. Leech*); TANZANIA: 1 ex., Mount Meru, 1700 m, 28.x.57 (*E. S. Ross and R. E. Leech*) (this and the previous 2 ex. in CAS, California); 1 ex., ZAIRE: Kivu, Butembo, 200 m, 19.xii.1952 (*P. Basilewsky*); 1 ex., Haut Vele, Moto, 1920 (*L. Burgeon*); 2 ex., Mombassa (36 km S. Lubero), viii. 1932 (*L. Burgeon*) (specimens in MRAC, Tervuren); 1 ex., Lwiro River, 47 km N. Bukavu, 1950 m, 27.viii.57 (*E. S. Ross and R. E. Leech*), 4 ex., 9 ml. S of Lubero, 2150 m, 23.ix.1957 (*E. S. Ross and R. E. Leech*) (specimens in CAS, California); GHANA: 1 ex., Ashanti region, Bobiri forest reserve, 320 m, N 6.40 – W 1.15, No. 77, 10.x.1965 (*Dr S. Endrody-Younga*), and three specimens with same data but No. 85, 17.x.1965 (2 ex.) and No. 141, 27.iii.1966 (all in TM, Budapest).

COMPARATIVE NOTES. The general facies, punctate-recticulate head and prothorax and striate elytra readily distinguish this species.

DISTRIBUTION. Ethiopian. Ghana, Zaire, Ethiopia, Kenya and Tanzania.

HABITATS. Ghanaian specimens were collected on moribund tall trees and those from Ethiopia under bark of decaying *Mimosa*.

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G. J. KERRICH

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BY
GEOFFREY JOHN KERRICH
Commonwealth Institute of Entomology

*Pp.* 113–199; 5 *Plates*, 15 *Text-figures*

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*By* G. J. KERRICH

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## SYNOPSIS

The species of this genus have been studied, so many as found practicable, from Africa south of the countries bordering the Mediterranean, from Asia south of the Caucasus and Himalayas, and from Australia. Two are regarded, at the species level, as common to all three continents; one known previously only from eastern Australia and one European species are recorded from southerly India. One African form is reduced in status to subspecies, six new synonymies are proposed and one species is recalled from synonymy. Seven new species are described from Africa, six from Asia, one from New Guinea and one from Australia. A new name is proposed in replacement of an overlooked secondary homonym. Lectotypes of the Waterston species and a neotype of one Risbec species are designated. A key is given to the African species, and another to the Asiatic and Australian species: species common to Africa and Australia or introduced are included in both. One new species is described from the neotropics and is compared with species from other parts of the world. A host-parasite list is given. Most of the species studied are associated with crop-plants.

## INTRODUCTION

This genus was, until 1953, known under Förster's name *Pleurotropis*, and in previous decades became well known under that name on account of the recognition of the economic importance of a number of species. Until less than 60 years ago, generic determination relied essentially on the keys of Förster (1856) and Thomson (1878), though Thomson also included *bimacularis* Dalman (*Mestocharis*). It would seem to have been more difficult to attain a generic determination from Ashmead (1904) and Schmiedeknecht (1909), though Crawford attributed a few species correctly to this genus.

A more satisfying definition of the genus was given by Waterston (1915), who laid a basis for our knowledge of the African species. It was Ferrière (1953) who established *Pediobius* Walker as the senior synonym.

Waterston's key and that of Masi (1940) have been used, together with determined material in the collection of the British Museum (Natural History), in the present author's attempts to name African material submitted to the Commonwealth Institute of Entomology (hereafter abbreviated to CIE). The present more intensive study has shown, however, that despite the collaboration with his artist described by Waterston, Terzi's beautiful drawings were not as accurate as one had been led to suppose, nor were drawings and descriptions fully in conformity in every case. Masi (1940) included species described since 1915 and three forms described as new: his key was, in some respects, more satisfactory than that of Waterston; but he does not seem to have received material of species described by other authors for study, and does appear to have been misled by Terzi's drawings as regards some features. His placement of some species after his key couplet 2 seems difficult to explain. The keys of Risbec (1951, 1958), based partly on Masi (1940), have not been used for making determinations: though his descriptions were extensive, he appears to have placed mixed series under one name, old or new, and some of his species were described from the male sex only, several from single males.

The only key to the species of southern Asia extant is that of Ferrière (1933), who included seven species, of which six are valid. Ferrière later (1940) described another species from Indonesia.

Our knowledge of the holarctic species was not placed on a more satisfactory basis until more recently. Graham (1959) gave a key to this, among most genera of Eulophidae other than Tetrastichinae, for the British species, and was rather soon followed by Bouček (1965), who wrote a comprehensive revision of the European species. The nearctic species have been treated by Burks (1966).

The present study arose from a request that I should give unequivocal determinations to the species associated with the Oil Palm Hispid in West Africa. Waterston (1925) had misdetermined one of these as one of his own species, and stated that the others must await treatment at a later date. This he never undertook. It was found necessary to obtain a clearer appreciation of the range of variation of the species, and that entailed a wider knowledge of the African forms. When such knowledge had seemed to attain a sufficiently satisfactory level, a preliminary diagnosis of the forms was given and the two new species were validated (Kerrich, 1970), so that the names could be applied by field entomologists in both Ghana and the Ivory Coast.

Another task requiring fulfilment was the designation of lectotypes of Waterston's African species, except for one that had, presumably by the author, been labelled and another that, by elimination, had been explicitly fixed.

It seemed natural to extend this study to the species of southern Asia, and this has proved immediately useful, since rather much material has been received from that area during the progress of this work, and some specific determinations have been given, which otherwise could not have been or not with confidence. Most of the generically determined material received by the CIE from that area has now been treated. It would have seemed a pity not to have included also a distinct species of economic importance received from the Caribbean area.

Thus, most regions of the world have now been covered. An exception is the Eastern Palaearctic, where some species have been described from Japan and one validated from Siberia by Walker. Two species are known to occur in New Zealand. A few species from Australia are treated here with the Asiatic: one, which I had confused with an Asiatic, is described as new; one, described from Australia, has been found also in India; and two, at the species-level, are considered as tropicopolitan. Assuredly, some species validated by Girault under generic names other than *Pleurotropis* belong here, but it would seem more profitable to base a study on freshly reared material before attempting to recognize his mutilated types. It seems that in the neotropics and near neotropics, the genus is replaced ecologically by *Horismenus*, hence the extreme paucity of species. The real centre of distribution of *Pediobius* is evidently in Africa: among the generically determined material received by the CIE a number of series of less distinctive species await further study.

In the treatment of species that follows, only the female specimens have been studied and described, except in a few cases in which it has been found necessary to make mention of the males also.

Abbreviations of names of Institutes and of Institutions in which type and other material is deposited are as follows:

| | |
|---|---|
| BMNH | British Museum (Natural History) |
| CIE | Commonwealth Institute of Entomology |
| CIBC | Commonwealth Institute of Biological Control |
| USNM, Washington | United States National Museum |
| ORSTOM, Paris | Office de la Recherche Scientifique et Technique Outre-Mer, Bondy (Seine) |
| MRAC, Tervuren | Musée Royal de l'Afrique Centrale, Belgium |
| MCSN, Genoa | Museo Civico di Storia Naturale |
| ANIC, Canberra | Australian National Insect Collection |
| IARI | Indian Agricultural Research Institute, New Delhi |

Locations of holotypes of all species are stated. Holotypes of new species are deposited in the BMNH with the exception of the Australian and New Guinean species described as new, of which the holotypes are deposited in the ANIC, Canberra. Paratypes and other specimens are deposited mainly in the BMNH, though in the case of species of which sufficient material is available, some are to be deposited in other institutions, especially the USNM, Washington.

Combinations in this genus are here recorded as new unless known to me to have been included in a systematic study, although a number have appeared in economic literature.

The ex-Belgian territory in Africa, often referred to as Congo (Kinshasa), is given its current name, Zaire, throughout this paper.

## Genus ***PEDIOBIUS*** Walker

*Entedon* (*Pediobius*) Walker, 1846 : 184–5. Type-species: *Entedon* (*Pediobius*) *imbreus* Walker, 1846, by subsequent designation (Ashmead, 1904 : 384). [*E. coedicius* Walker, 1846 : 183, designated by Ashmead (1904 : 344), was not originally included explicitly.]

*Pleurotropis* Förster, 1856 : 78, 82. Type-species: *Pleurotropis isomera* Förster, 1861 : 37, by monotypy.

*Pleurotropis* Thomson, 1878 : 239, 248–50. [Not explicitly attributed to Förster. Ashmead (1904 : 386) made an alternative designation as type-species of *Entedon bimacularis* Dalman, presumably taking the species placed first by Thomson, but this was not originally included by Förster.]

*Pleurotropis* Förster; Waterston, 1915 : 343–5.

*Pediobius* Walker; Ferrière, 1953 : 400.

*Pediobius* Walker; Graham, 1959 : 185–6.

*Pediobius* Walker; Bouček, 1965 : 7–10.

*Pediobius* Walker; Kerrich, 1969 : 215–6.

The above table refers to characterizations of the genus, as distinct from a generic synonymy which has been given by Bouček (1965).

Entedontinae with head, thorax and propodeum strongly sclerotized, so that the head is not normally collapsed in death: gaster very distinctly petiolate, the petiole strongly sclerotized and distinctly sculptured, relatively long in male. Antennae of female about on lower level of eyes. Dorsum of mesothorax very distinctly sculptured, the mesoscutum with no median furrow, with notauli defined, and with a pair of notaular pits at hinder end, shallow and ill-defined to rather deep and more or less well defined, each bearing a main seta. Propodeum (see Plates) having strong plicae laterales and a pair of strong submedian carinae, which diverge from base more or less gently in female, comparatively strongly in male, but which in a very few species are nearly parallel or are coalesced from base to near apex.

The following characters also apply with, in each case, very few exceptions. Occipital carina strong, continuous to below level of top of eyes, the head sharply declived behind it. Sides of upper face distinctly reticulate. Eyes more or less distinctly hairy. Antennae of female having three funicle and two club segments and a terminal spine. Pronotum bearing, in dorsal view, six strong setae, the collar sharply margined, smooth or with sculpture sharply contrasting with that on the rather finely and regularly reticulate anterior part. Notaular pits well separated. Propodeum above, between the carinae, smooth and shining, or with reticulate sculpture very fine and incomplete. First large tergite brightly metallic coloured on about basal half and on sides above, and smooth on this region.

Nearly all species fit one of two alternative venational conditions as stated near the end of this paper.

*P. setigerus* Kerrich, in having the scutellum bearing ten to twelve strong setae on either side, is exceptional among the Entedontinae.

The distribution of this genus is almost world-wide; but it appears that Africa contains the greatest number of species, while very few are known to have been found in the neotropical region.

## AFRICAN SPECIES

### *Pediobius ropalidiae* (Risbec) comb. n.

(Pl. 1, fig. 1)

*Pleurotropis ropalidiae* Risbec, 1958 : 68–72, 87–90. Holotype ♀, ZAIRE: Basoko (MRAC, Tervuren).

Bristles on head, thorax and upper surface of pedicellus relatively short and stout, black.

Head, seen from above, broad, about two and a half times breadth of its median length, broadly emarginate in front. Frontovertex about one and a half times breadth of its median length and nearly three times breadth of an eye, with ocelli in about a right-angled triangle; with reticulation rather strongly outstanding but rather fine to only moderately coarse. Sides of upper face scarcely less strongly reticulate: lower face, clypeus and genae very much more weakly but very distinctly reticulate. Eyes very strongly but very sparsely hairy.

Antenna having scape about four, and pedicellus about one and a quarter, times the length of its greatest breadth: funicle almost parallel-sided, the first segment about quadrate, the second and third distinctly transverse, and basal club segment of about the same breadth.

Pronotal collar short, almost covered with extremely fine reticulation, its sides slightly narrowed, emarginate. Notauli deeply impressed anteriorly, leading to notaular pits that are very ill-defined, and bear the main seta rather near the hind margin: sculpture of mesoscutum and scutellum generally rather regular, as on frontovertex but usually a little coarser on mesoscutum and coarser still on scutellum, finer in the notaular pits but sometimes considerably coarser on mid lobe: hind margin weakly sinuate. Propodeum having submedian carinae sub-parallel for much more than half way back, then strongly divergent, rather weak and often comparatively far apart, the surface between and near beside them with very fine reticulation or indication of such, and with no median carina: nucha extremely short, deeply emarginate at apex: spiracles oval, the spiracular area, seen from above, produced into a sharp, jagged tooth above the hind coxa.

Petiolar segment very strongly transverse, about three times as broad as long, finely reticulate, strongly convex in middle and not with strong anterior margin. Remainder of gaster elongate-oval, extremely delicately reticulate on the brown parts, the first large tergite a little more than one-third its length in mature specimens.

Hind tibial spur straight, reaching a little beyond apex of metatarsus.

Head bright blue-green, with frontovertex and sides of upper face often overspread with blue to red-violet, or occasionally with bronzy. Antennae with scape pale testaceous, sometimes darkened above, and pedicellus and flagellum dull brown, with weak metallic reflections. Dorsum of thorax coloured similarly to head: propodeum above with bright, pale brassy reflection: sides of thorax and propodeum a much darker green, with bronzy reflection. Gaster brown, more or less shining, the first large tergite blue-green to blue or red-violet in about basal half, and the hinder tergites often blue-green along their lateral margins. Legs having coxae wholly or partly dark blue-green, beyond that pale testaceous, with only slight metallic darkening on the femora, and the last tarsal segment slightly darkened towards apex.

The gaster is weakly sclerotized, and in semi-teneral female specimens it appears much longer than head, thorax and propodeum combined, but in fully mature specimens it appears slightly shorter.

Redescribed from the following. TANGANYIKA: Tanga, numerous ♀♀, viii–ix.1917 (*W. A. Lamborn*). MALAWI: Karonga, numerous ♀♀, 1919 (*W. A. Lamborn*). GHANA: Legon, numerous ♀♀, i.1969 (*O. W. Richards*). ZAIRE: Basoko, 1 ♀, ii.1949, 'parasite de *Ropalidia guttatipennis*' (*P. G. L. Benoit*) (paratype); a female paratype recorded as reared from *Belonogaster junceus* Fabricius has also been studied. Males of all series are available.

Further specimens reared by Benoit from both wasp genera have been seen: they are deposited in ORSTOM, Paris and are mounted on four slides.

BIOLOGY (see Richards, 1969). Most of the Lamborn specimens are labelled '*ex* Tachinid puparium' and such puparium is included with one series, but others are labelled '*ex* Vespid nest' or '*ex Belonogaster* nest'. Richards recorded the *Pediobius* as reared from *Anacamptomyia bisetosa* (Roubaud & Villeneuve), a Tachinid parasite of the wasps, and evidently from pupae of *Belonogaster* and *Polistes*, some of which were found with emergence holes of appropriate size. Female *Pediobius* were found sitting in a bloated condition on wholly or partly collapsed eggs of the same wasp genera: we presume they suck the wasp eggs to obtain nourishment for maturing their own.

## ***Pediobius rhyssonotus* sp. n.**

*Pleurotropis rhyssonotus* Waterston, 1917 MS.

Head, seen from above, rather deeply emarginate in front, nearly 2·5 times breadth of its median length. Frontovertex about one and a quarter times breadth of its median length and nearly twice the breadth of an eye, with ocelli in a very slightly obtuse triangle; with reticulation rather strong and regular, though considerably finer behind. Whole upper face moderately reticulate: lower face, clypeus and genae more weakly and finely so. Eyes rather weakly and moderately densely hairy.

Antenna having scape four times and pedicellus twice length of its greatest breadth: funicle rather strongly broadened in side view, the first segment a quarter longer than broad, the second about quadrate, the third about a quarter broader than long, the segments strongly petiolate at apex.

Pronotal collar with reticulation fine but decidedly outstanding, not at all smooth, its sides strongly rounded, broadened at first then strongly narrowed. Notauli fine, sharply impressed, leading to notaular pits that are of moderate depth but are ill-defined, and bear the main seta nearly half way forward; sculpture of mesoscutum almost entirely strongly outstanding, reticulate behind middle of mid lobe, merging to striate-reticulate elsewhere, the striae tending to be concentric around the mid point of the hind margin, which is very weakly sinuate. Scutellum strongly longitudinally striate, the striae converging to mid point of hind margin, narrowly in mid line much more finely reticulate. Propodeum having submedian carinae diverging gently for most of the way back, then curving strongly outward, with median carina strong in the unique female (though absent in all but one of the male specimens), the whole surface covered with outstanding fine reticulation and rugae, not at all smooth: nucha rather deeply but narrowly emarginate at apex: spiracles small, short-oval, the spiracular area, seen from above, produced into a strong, sharp tooth above the hind coxa.

Petiolar segment a little broader than long, covered with outstanding fine reticulation, and with longitudinal ridges rather strong but incomplete. First large tergite about half length of gaster beyond petiole, extremely finely and delicately reticulate almost all over, the following tergites with normal fine reticulation.

Hind tibial spur straight, reaching well beyond apex of metatarsus.

Head and thorax very dark blue-green, with overspread of bronzy, brighter on sides of thorax: propodeum a much brighter blue-green, with pale reflections. Antennae blue-green with bronzy reflections. Gaster brownish black, the first large tergite dark blue-green in about basal half and the last tergite dark blue-green. Legs dark blue-green, the tibiae paler towards apex, the tarsi very pale stramineous, with the apical segment lightly infuscate.

Holotype ♀. UGANDA: Kampala, 'bred from Lymantriid no. 6060', 12.viii.1916 (*G. C. Gowdey*) (BMNH).

This species has stood in the collection of the British Museum (Natural History) over this manuscript name for over half a century. It is thought well to describe it because of its distinctness. Although, unfortunately, the female specimen is unique in that sex, there are five male specimens, one of them dissected, from the same reared series and exhibiting the same distinctive sculpture. The male specimens have been studied sufficiently to verify the description based on the female.

### ***Pediobius taylori*** **sp. n.**

(Text-fig. 4)

Head, seen from above, about 2·2 to 2·3 times breadth of its median length. Frontovertex broader than its median length and about twice breadth of an eye, with ocelli in about an equilateral triangle, the lateral very distinctly more than their longer diameter from orbital and occipital margins; with reticulation of moderate strength and in greater part regular, much more weakly and finely so immediately beside and behind the lateral ocelli but soon merging to more strongly and coarsely so. Sides of upper face rather finely reticulate. Eyes moderately strongly and densely hairy, in facial view strongly convergent below and extending far below level of toruli, the cheeks very sharply narrowed. (Text-fig. 4).

Antenna having scape rather slender, about five times length of its greatest breadth: funicle strongly broadened in side view, the first segment about one and a half times length of its greatest breadth, the second and third moniliform, the second about as long as broad and third about one and a half times as broad as long: basal club a little broader than third funicle segment.

Pronotal collar short, the fore and hind margins almost parallel, the sides rather strongly narrowed. Notauli anteriorly moderately but nowhere sharply impressed: notaular pits rather shallow, not bordered on inner or outer side and bearing the main seta about two-fifths the way forward: mesoscutum having reticulation in greater part of moderate strength and rather regular, though merging to longitudinal between the notaular pits and much finer in them: hind margin moderately sinuate. Scutellum weakly longitudinally striate-reticulate, narrowly in mid line in about anterior two-thirds very weakly longitudinally reticulate to almost smooth. Propodeum having submedian carinae close at base, subparallel or diverging very weakly at first, then diverging much more strongly but at much less than 45°, and with no evident median carina: nucha short, broadly almost truncate at apex: spiracles small, short-oval, more than their longer diameter from margin of metanotum, the spiracular area, seen from above, produced into a small tooth above the hind coxa.

Petiolar segment over one and a half times length of its greatest breadth, finely reticulate, with anterior margin narrowly exceptionally strongly raised. Gaster beyond petiole oval, not pointed toward apex, markedly more densely hairy than in *neavei* (Waterston) and *foveolatus* (Crawford): first large tergite much less than half its length, with no more than extremely superficial reticulation near mid apex: following tergites finely but very distinctly reticulate almost throughout, the smooth apical margins very narrow.

Hind tibial spur slightly curved, very strong, extending well beyond middle of second tarsal segment.

Head, seen from above, pale bronzy, dark blue-green beside and behind the lateral ocelli; in facial view dark blue-green to dark blue, the sides of upper face overspread with dark bronzy. Antennae dark blue-green. Pronotum before collar and mesoscutum pale bronzy above merging to blue-green at sides: pronotal collar and scutellum dark blue-green to dark blue or blackish, often with infusion of pale bronzy anteriorly: mesopleura and sides of propodeum dark blue, with bronzy patch on mesopleura: propodeum above bright blue-green. Gaster dull bronzy to blackish, the first large tergite blue-green to mostly blue in greater part, often almost wholly, and with blue-green coloration on the last two visible tergites. Coxae, trochanters and femora dark blue-green to mostly blue: tibiae mostly a much brighter blue-green: tarsi whitish, with the apical segment infuscate.

Rather small species: length about 1½ mm.

Holotype ♀. UGANDA: Kampala, v.1940, *ex* suspended cocoons of Ichneumonid (*Charops* sp.) *ex Metadrepana* sp. (*T. H. C. Taylor*) (BMNH).

Paratypes. UGANDA: 14 ♀♀, same data as holotype; Kampala, 9 ♀♀, x.1936 '*ex* Loranthus, probably primary or secondary parasite of *Mylothris* pupa' (*T. H. C. Taylor*). One male is present in the first and several in the second series.

Named for the late Dr T. H. C. Taylor, who reared this and numerous other species, and who first suggested that I might study this genus.

## *Pediobius angustifrons* sp. n.

Head, seen from above, rather strongly emarginate in front, over twice breadth of its median length. Frontovertex narrow, its breadth across median ocellus about two-thirds its median length and distinctly less than the breadth of an eye, with ocelli in about an equilateral triangle, the median little more than its own breadth from orbital margin; strongly reticulate, though much more finely so beside and behind the lateral ocelli. Sides of upper face finely reticulate. Eyes extending slightly below level of toruli, strongly and very densely hairy.

Antenna having scape about five times length of its greatest breadth: funicle having first segment about twice length of its greatest breadth and third a little longer than broad, the segments strongly petiolate at apex.

Sides of pronotal collar rather strongly narrowed. Notauli sharply impressed and with sharp anterior margin, which continues as an anterior margin of the sub-triangluar notaular pits; these bear deep longitudinal impressions, and the main seta about one-third the way forward, the space between them being much narrower than a pit: mid lobe of mesoscutum with reticulation rather strong, merging to striation between the notaular pits, the parapsides weakly striate-reticulate above, more strongly reticulate at sides, hind margin deeply emarginate in the middle. Scutellum rather strongly and rather coarsely striate-reticulate at sides merging to reticulate, in about hinder half, much more weakly sculptured near mid line in anterior half. Propodeum having submedian carinae sub-parallel or gently divergent some way from base, then curving more strongly outward, and with median carina varying from just indicated to moderately strong: nucha narrowly emarginate at apex: spiracles rather elongate-oval, the spiracular area, seen from above, produced into about a right-angled tooth above the hind coxa.

Petiolar segment about a quarter longer than broad, rather finely reticulate, the anterior margin strongly raised in middle. First large tergite a little less than half length of gaster beyond petiole: reticulate sculpture on dark parts of first two large tergites very distinctly outstanding in larger specimens, becoming gradually weaker and finer on hinder tergites.

Hind tibial spur curved, very strong, reaching nearly to apex of second tarsal segment.

Coloration of forms from Kenya, Tanzania and Malawi: head greenish blue, occasionally with red-violet on frontovertex, with considerable overspread of bronzy on upper face, the clypeus blue-green. Antennae blue-green, the pedicellus often darker in part. Thorax and propodeum blue-green to greenish blue, occasionally with red-violet tinge, and with bronzy coloration at sides. Gaster blackish brown, the hinder tergites often with sea-green hind margins, the first large tergite greenish blue, except for a large median apical mark. Legs blue-green, the tibiae narrowly stramineous at apex, the tarsi stramineous, with only the claws darkened.

Coloration of form from Sierra Leone differs as follows: frontovertex mainly red-violet, thorax and propodeum above usually mainly red-violet, though sometimes the mesoscutum pale bronzy and the pronotal collar and scutellum greenish blue, antennae and legs with red-violet among the green parts. The Uganda specimen also is largely red-violet. The Sierra Leone series is very much the longest available, so it is from this that the holotype is designated.

Holotype ♀. SIERRA LEONE: Njala, 5.x.1929, '*ex* larva of ?Dasychira sp.' (Lep., Lymantriidae) on *Cola* sp. (*H. Hargreaves*) (BMNH).

Paratypes. SIERRA LEONE: 36 ♀♀, same data as holotype. MALAWI: Namiwawa, 10 ♀♀, 19.iv.1922, *ex* cocoon mass on unknown caterpillar (*C. Smee*). UGANDA: Kampala, 1 ♀, 4.iii.1924, '*ex* cocoon with appendage' (*Apanteles* sp.) (*G. L. R. Hancock*). KENYA: Ruiru, 1 ♀, xii.1965, *ex Apanteles* cocoon from *Ascotis* larva (*D. E. Evans*); Kiambu, 1 ♀, 17.v.1966, '*ex Odites* pupa' (*O. Andrade*). Males are present in the Sierra Leone and Uganda series.

## ***Pediobius neavei*** (Waterston) **comb. n.**

*Pleurotropis neavei* Waterston, 1915 : 345–50, 353, 357, 361. Holotype ♀, MALAWI: Mlanje (BMNH) [examined].

*Pleurotropis neavei* Waterston; Masi, 1940 : 301–3.

Head, seen from above, about 2·3 to 2·6 times breadth of its median length. Frontovertex about as broad as its median length one and a half times to about twice breadth of an eye, with ocelli in a strongly acute to right-angled triangle; strongly reticulate, though more finely so before the median ocellus, and more finely and much more weakly so beside and behind the lateral ocelli. Sides of upper face rather finely to moderately reticulate. Cheeks strongly narrowed. Eyes densely hairy.

Antenna having scape about five times length of its greatest breadth: funicle having first segment about twice length of its greatest breadth and third a little longer than broad, the segments strongly petiolate at apex.

Sides of pronotal collar rather strongly narrowed. Notauli sharply impressed and with sharp anterior margin, which continues as an anterior margin of the broad-oval notaular pits; these bear the main seta nearly half way forward, the space between them being very much narrower than a pit: mid lobe of mesoscutum with reticulation of moderate strength to rather strong and regular, merging to irregular striation between the notaular pits, the parapsides finely to very finely striate: hind margin strongly sinuate. Scutellum strongly and coarsely striate at sides merging to reticulate behind, in middle in about anterior two-thirds much more weakly sculptured, sometimes almost smooth, notably in cotype series. Propodeum having submedian carinae moderately divergent, sometimes comparatively far apart at base, with median carina absent or merely indicated, rarely strong and almost complete as would appear from Terzi's drawing (Waterston, 1915, p. 347): nucha broadly almost truncate or narrowly emarginate at apex: spiracles small, elongate-oval, the spiracular area, seen from above, produced into a small, rather sharp tooth above the hind coxa.

Petiolar segment transverse, very finely reticulate. Gaster beyond petiole relatively elongate and pointed, the first large tergite less than half its length: delicately reticulate on dark part of first large tergite, and much more finely so on following tergites.

Hind tibial spur curved, reaching well beyond apex of metatarsus.

Frontovertex bright blue-green to greenish blue: head otherwise a duller blue-green, with considerable overspread of bronzy. Antennae blue-green, often with weak brassy reflection.

Thorax and propodeum blue-green, often with much bronzy reflection. Gaster dull bronzy, the hinder tergites sometimes with blue-green hind margins, the first large tergite bright blue-green except for a large, median apical mark. Legs blue-green, the tibiae pale at apex, the tarsi stramineous, only slightly darkened towards apex of fourth segment.

In the cotype series the head, notably the frontovertex, is comparatively narrow, with the ocelli in a strongly acute triangle, the scutellum is almost smooth in middle in about anterior two-thirds and the submedian carinae of the propodeum are comparatively far apart at base. The two specimens described by Waterston as a variety of this species, together with the other material now studied, have the head, notably the frontovertex, broader, with the ocelli in a right-angled triangle, the scutellum in middle in about anterior two-thirds much more weakly yet more or less distinctly sculptured, and the submedian carinae of the propodeum often closer at base. There may be a biological difference, since the cotype series was reared from a *Charaxes* pupa whereas the other series were reared from *Apanteles* cocoons, but pending the accumulation of further evidence I prefer to treat all these series studied as belonging to the same species.

In the collection of the British Museum (Natural History) are card mounts of seven ♀♀ out of eight recorded as reared by S. A. Neave, eight slides of parts of the female and six of the male (not recorded). One card-mounted specimen bears a red type label 'TYPE H T.' (=holotype), and is evidently an original type-designation. In the collection is also a *Charaxes* pupa bearing the same data and with two holes through which the *Pediobius* presumably emerged: Waterston wrote that the species was 'not improbably a hyperparasite on some species of *Chalcis*' (*i.e. Brachymeria*), but its status remains conjectural.

Further material studied. UGANDA: Bukoba, 2 ♀♀, 10.vi.1912, *ex Apanteles* cocoons (*C. C. Gowdey*) (each specimen mounted on a card with several cocoons) (this is the original material of *neavei* var. Waterston); Gulu, 13 ♀♀, vii.1936, *ex* massed cocoons of *Apanteles* from Sphingid larva (*T. H. C. Taylor*). KENYA: Ruiru, 1 ♀, vi.1966, '*ex* sp. A' (*O. Andrade*). Two males are present in Taylor's series.

## ***Pediobius foveolatus*** (Crawford) subsp. ***mediopunctatus*** (Waterston) **comb. et. stat. n.**

(Text-fig. 7)

*Pleurotropis mediopunctatus* Waterston, 1915 : 345, 348, 353, 357–60. LECTOTYPE ♀, NIGERIA: Ibadan (BMNH), here designated [examined].

This is treated extensively in the present work among the Asiatic species (pp. 163–165) but is, of course, included also in the key to the African species studied.

Syntype material. NIGERIA: Ibadan, 4 ♀♀, vii.1913, *ex* pupa of *Epilachna, s.l.*, sp. (det. R. D. Pope) (*W. A. Lamborn*).

The four specimens, one now lacking the gaster, were mounted on a card together with the pupa-case of the host (Text-fig. 7). I select as lectotype the specimen in the top right-hand corner, indicated by an arrow in the artist's drawing. The host pupa-case has subsequently been found to be missing.

## *Pediobius setigerus* Kerrich

(Pl. 1, fig. 2)

*Pediobius setigerus* Kerrich, 1970 : 327–8. Holotype ♀, Ghana: Pretsea (BMNH) [examined].
*Pediobius* sp., 'parasite', Mariau & Morin, 1971 : 86.

Head, seen from above, about two and a quarter to two and a half times breadth of its median length. Frontovertex about or nearly twice the dorsal breadth of an eye and somewhat broader than its median length, with ocelli in about a right-angled triangle; with reticulate microsculpture in well-developed specimens almost throughout, just clearly distinct × 65. Sides of upper face with reticulation very fine, just comfortably distinct × 65 except above. Eyes extending well below level of toruli, sparsely and very finely hairy (× 100).

Antenna having scape about seven times and pedicellus twice length of its greatest breadth: funicle not broadened in side view, the first segment about one and two-thirds, the third about one and a half times, length of its greatest breadth, the segments clearly narrowing to apex.

Pronotal collar almost parallel-sided, slightly rounded at sides, bearing about sixteen strong setae immediately behind the elevated fore margin and on sides. Notauli rather strongly impressed, running to sub-triangular notaular pits, which bear the main seta near the front and sometimes a subsidiary seta nearer middle: mesoscutum with reticulation rather fine to moderate and with setae stout and rather numerous: hind margin very weakly sinuate. Scutellum about as broad as long, with reticulation weak and rather fine but always quite distinct except near apex, broadly in mid line, merging to much coarser and stronger at sides, and bearing about ten strong setae on either side. Propodeum having submedian carinae rather close together at base, curving gently outward and moderately divergent but at less than 45°, and with at least a slight indication of a median carina: nucha rather short, broadly and weakly emarginate at apex: spiracles small, oval, the spiracular area, seen from above, produced into a tooth or lobe above the hind coxa and with a smaller projection further forward.

Petiolar segment longer than broad, with anterior margin comparatively narrowly raised in middle, rather finely reticulate, with longitudinal ridges at sides but not above. First large tergite generally about two-thirds length of gaster beyond petiole (but the proportion varying considerably), smooth, the following tergites with extremely fine sculpture.

Hind tibial spur short and straight, not reaching apex of the relatively short corresponding metatarsus.

Frontovertex blue-green, most often merging to dull blue before the ocelli, with a red-violet patch on temples, usually having the inner orbits narrowly bronzy and with a greater or lesser amount of bronzy along occipital margin: upper and lower face blue-green, the upper face overlain with blackish bronzy. Antennae blue-green. Dorsum of thorax and propodeum green, or largely turquoise to ultramarine or red-violet, often with a faint, incomplete, median bronzy stripe on the mesoscutum and/or bronzy in the notaular pits. Gaster bronzy, with first large tergite in usually more than basal half, and last large tergite blue-green, occasionally tinged with red-violet. Legs blue-green, the tibiae paler at extreme base and apex, the tarsi stramineous, with the apical segment and usually the preapical segment at apex lightly infuscate.

Detailed description made from holotype and numerous paratypes: Ghana, Ivory Coast. I do not now believe that the specimen mentioned as having an elongate gaster (Kerrich, 1970) belongs to a different species: several tergites are evidently telescoped out. Variation in relative length of the gaster and proportions of its tergites has also been found in other species.

Biology. Reared from larvae of the Oil Palm Hispid beetle, *Coelaenomenodera elaidis* Maulik. Almost all accurate records are of this as a primary parasite, though one male specimen was reared as a hyperparasite (see Kerrich, 1970). See also Mariau & Morin (1971 : 86).

## ***Pediobius acraconae* sp. n.**

(Text-figs 1–2)

Head of quite unusual form for this genus, as seen from above (Text-fig. 1) rounded before and behind eyes, and extending some way behind eyes: with ocelli in about an equilateral triangle, and occiput narrow and sloping backward, so that it is clearly visible in this view. Head, seen from above, about 2·4 times breadth of its median length to occipital margin: frontovertex one and a third times this length and two and a half times breadth of an eye. Frontovertex, temples and clypeus shining, in part with extremely fine, irregular sculpture discernible × 65: reticulation on occiput rather fine, on sides of upper face moderate to rather fine, merging to very fine below and on the well raised inter-antennal prominence. Eyes sparsely but quite distinctly hairy.

Antenna having scape about four and a half, and pedicellus about two and a half times length of their greatest breadth: first funicle segment about two and a quarter times length of its greatest breadth, almost rectilinearly broadened above and slightly decurved below, the second and third normally slightly longer than broad and slightly broadened, and club about as long as first funicle segment: however, there is irregularity in proportion in different specimens.

Pronotal collar short in mid line but the sides long, broadened, emarginate in middle and doubly rounded. Notauli sharply impressed, continuing as inner margins which extend about half way back round the diagonally-directed, oval notaular pits, these being of moderate depth and bearing the main seta near inner side and about a third the way forward or less: mid lobe of mesoscutum except at sides with sculpture weak and rather fine, concentrically striate-reticulate anteriorly, transversely so in middle and more regularly so behind: reticulation on remainder of scutum much finer, in notaular pits very weak: hind margin evenly curved. Scutellum distinctly broader than its median length and distinctly more convex than mid lobe of scutum, moderately longitudinally striate-reticulate at sides, and with a broad median band, a little broader than the interspace between the notaular pits, shining and smooth or almost so. Propodeum having submedian carinae close at base and gently divergent, fine and weak, sometimes irregular and no stronger than the median carina which may join one of them before base, and having the dorsal surface between the spiracles very finely reticulate to striate-reticulate: nucha prominent, more than half length of the part of the propodeum before it, very finely reticulate but rather shining near mid line: spiracles prominent, oval, more than their longer diameter from margin of metanotum, the spiracular area produced into a small rounded lobe above the hind coxa.

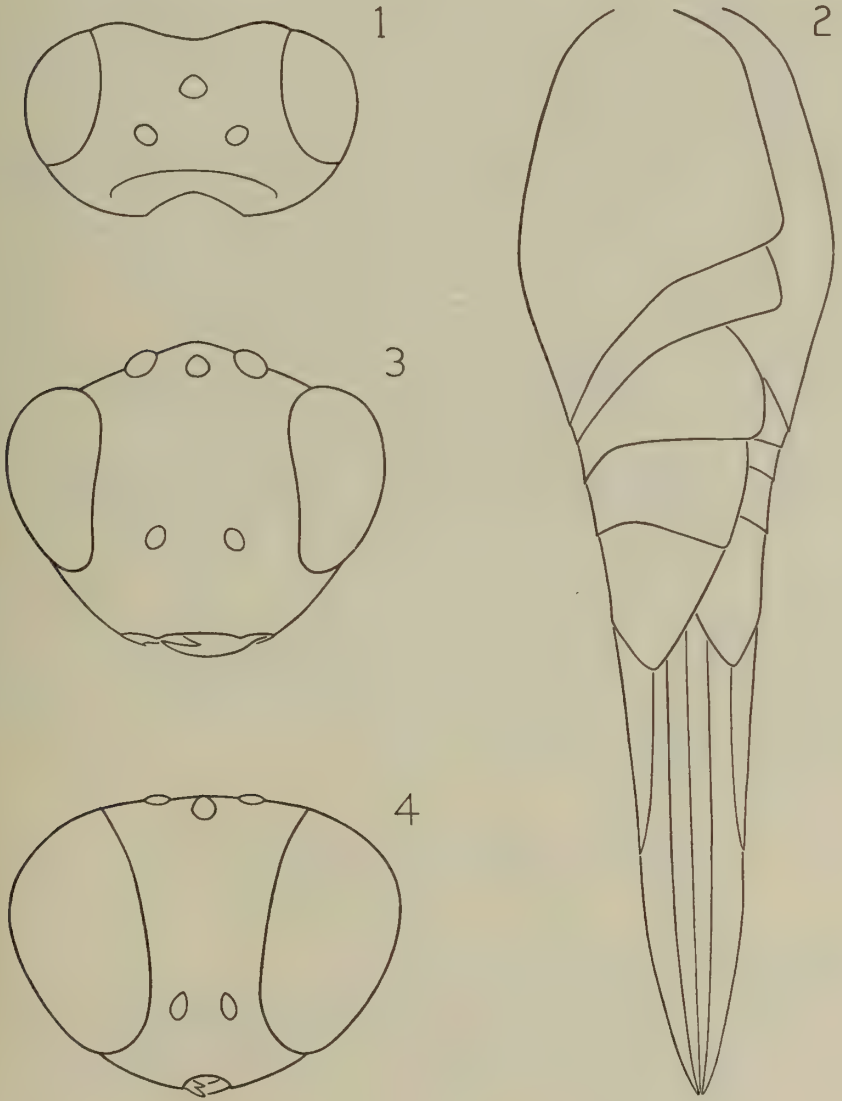
Petiolar segment finely and, on hinder half, transversely reticulate; having anterior margin shallow cup-like, not or hardly raised in middle but strongly produced forward at sides, embracing the nucha; behind this marginal part moderately expanded to apex, the median length of the segment a little less than its least breadth. Remainder of gaster (Text-fig. 2) very elongate, much longer than head, thorax and propodeum combined; the first large tergite bulbous, those following narrowed, the second almost or quite covered above though clearly visible at sides and below, the following much more elongate, the first five strongly overlapping their opposite sides beneath, those beyond the third moderately densely beset with semi-decumbent pubescence.

Fore wings slender, about three times length of their greatest breadth, when folded back about reaching apex of penultimate large tergite. Legs exceptionally slender, the hind femur over five times length of its greatest breadth, the hind tibial spur about three-fifths length of corresponding metatarsus.

Frontovertex and occiput shining blackish: upper face dark bronzy, merging to dark blue-green on genae, lower face and clypeus. Antennae pale brown to blackish brown, with weak metallic reflection: the specimens with paler antennae perhaps to some extent teneral. Thorax and propodeum shining blackish, the propodeum sometimes with infusion of blue-green or bronzy. Gaster shining blackish. Legs with coxae brownish black to blackish brown, becoming gradually paler to the tarsi, which are pale testaceous except at apex.

*Male* differs as follows—head, seen from above, only a little narrowed behind eyes, the eyes relatively small and the occiput relatively broader than in female, and the ocelli in an obtuse triangle. Head, seen from above, three times breadth of its median length to occipital margin: frontovertex twice this length and four times the breadth of an eye.

Antenna having scape about two and three-quarter and pedicellus one and a half times length of their greatest breadth: funicle 2-segmented, the first almost parallel-sided and nearly



FIGS 1–4. 1–2. *P. acraconae* sp. n. 1. Head, seen from above; 2, gaster in ventral view. 3–4. Head in facial view of 3, *P. clinognathus* (Waterston) and 4, *P. taylori* sp. n.

three times as long as broad, the second decidedly broadened, scarcely longer than its greatest breadth, and club very much broader than second funicle segment, almost circular in outline.

Propodeum having nucha relatively rather shorter: spiracles short-oval, about their longer diameter from margin of metanotum.

Petiolar segment with reticulation not evidently transverse; produced forward medially into a smooth neck which articulates with the nucha; having anterior angles not especially prominent, the sides margined and moderately rounded, the reticulate part over one and a half times breadth of its median length. Remainder of gaster a little longer than head, thorax and propodeum, not of normal masculine form for the genus but triangularly narrowed beyond the first large tergite, which is expanded and only slightly rounded at sides; beyond the third large tergite sparsely beset with strong, almost erect, setae. Micropterous, the wings relatively strongly hairy, the fore wings about three times length of their greatest breadth, when folded back reaching about to apex of first large tergite. Legs comparatively stout, the hind femur hardly three and a half times length of its greatest breadth, the hind tarsus short, not much more than half length of the corresponding tibia, the hind tibial spur strongly curved and far overreaching the corresponding metatarsus, which is distinctly shorter than the second tarsal segment.

Upper and lower face purplish bronzy. Legs markedly darker than in the female, especially the tarsi.

Holotype ♀. NIGERIA: Ibadan, 17.ii.1961, *ex* larva of *Acracona remipedalis* Karsch (Pyralidae, Galleriinae) in ants' nest (*L. A. Mound*) (BMNH).

Paratypes. 6 ♀♀, 2 ♂♂ (including allotype), same data as holotype.

BIOLOGY (see Mound, 1962). The above-cited specimens, with others, had emerged from a last instar larva of the host in the ants' nest. This is a hard nest of a species of *Crematogaster* determined as ? *depressa* Latreille: the ant material cannot be traced at this time but Mr B. Bolton, who has studied ants in that area, informs me that it would probably have been either *depressa* Latreille or *africana* Mayr. The nomenclature of the commensal was rectified by Whalley (1962). I am quoted by Mound as writing of the parasites 'The males are micropterous, the aedeagus protruding, which suggests that they may mate with their sisters and never escape from the ants' nest.' The small size of the eyes and the strong, presumably sensory, setae on the hinder tergites would support this suggestion.

The species looks so very unlike an ordinary *Pediobius* that I did not recognize it as belonging to this genus in 1961.

### ***Pediobius aspidomorphae*** (Girault) **comb. n.**

(Pl. 5, fig. 9; Text-figs 5, 6)

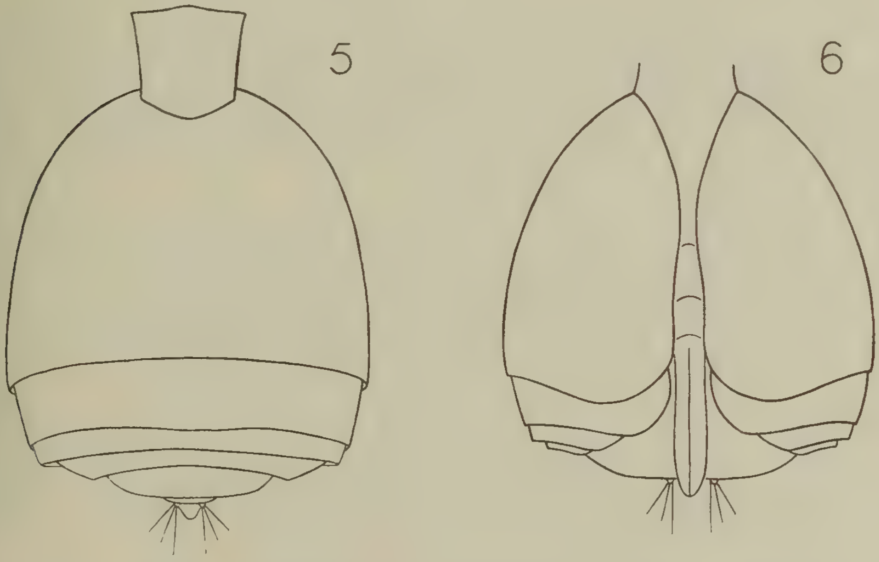
*Pseudacrias aspidomorphae* Girault, 1938 : 75. Syntypes, ♀ recorded as ♂, AUSTRALIA: Queensland, Brisbane (Queensland Museum, Brisbane).

Head very broad, about two and three-quarters times breadth of its median length. Frontovertex two and two-thirds times the dorsal breadth of an eye and more than one and a half times breadth of its median length, with ocelli in a right-angled or slightly obtuse triangle; in greater part in Kenya series rather dull, finely and weakly reticulate, though the reticulation distinct × 45, but beside the lateral ocelli shining, with sculpture very much weaker: smaller specimens have the reticulation mostly rather indistinct, though often much more distinct on inter-ocellar area. Sides of upper face rather weakly reticulate, becoming more coarsely so towards mid-line. Eyes with pilosity rather sparse but of moderate strength.

Antenna in Kenya series having scape slender, about seven times length of its greatest breadth, yet not nearly reaching the median ocellus: funicle slightly broadened in side view, the first segment about one and a half times length of its greatest breadth, the third nearly as broad as long, the segments distinctly petiolate at apex, relatively sparsely beset with outstanding hairs: in the smaller specimens of the other series the flagellar segments are relatively somewhat shorter.

Pronotal collar short, bearing extremely fine reticulation just discernible × 65, its sides moderately to rather strongly narrowed. Notauli finely and sharply impressed: notaular pits rather well-defined, sub-triangular, more or less finely but distinctly reticulate, and bearing the main seta rather near inner side: reticulation on mesoscutum strongly outstanding, finer anteriorly before the notauli, merging to much coarser in middle and behind, sometimes striate-reticulate between the notaular pits: hind margin gently curved, very weakly sinuate in middle. In the Uganda series the notaular pits are less well defined but very deeply impressed. Scutellum rather strongly convex, having reticulation coarse or rather coarse and strongly outstanding, in greater part longitudinal though more rounded posteriorly and sometimes in middle, and finer anteriorly in mid-line: smooth or almost smooth at mid-apex. Propodeum having submedian carinae diverging gently and with a median carina or trace of such; the median area with a well-marked pair of cavities before the nucha, which is weakly emarginate at apex: spiracles short-oval, small, much more than their longer diameter from margin of metanotum, the spiracular area, seen from above, produced into a strong, sharp tooth above the hind coxa.

Petiolar segment a little longer than its basal breadth and markedly narrowed from base, with anterior margin strongly raised, rather finely and, for this structure, comparatively outstandingly reticulate, without or with merest indications of longitudinal ridges above. Female gaster (Text-figs 5–6) not, as in most species, gradually more or less pointed but of masculine form, very broadly rounded at apex, apart from the ovipositor sheaths and with epipleura that almost or quite meet mid-ventrally for a considerable length. First large tergite about two-thirds length of gaster beyond petiole, with sculpture on the bronzy part often not



FIGS 5–6. Gaster of *P. aspidomorphae* (Girault), 5, seen from above and 6, in ventral view.

distinct × 100: reticulation on second large tergite delicate but quite distinct, and on the following tergites extremely fine.

Hind tibial spur almost straight, reaching well beyond apex of metatarsus.

Head dark blue-green to blackish blue, often with overspread of bronzy and sometimes red-violet. Antennae blue-green to blue. Thorax and propodeum blue-green, the sides darker, the thoracic dorsum to a lesser or greater extent overspread with bronzy, in the Uganda series mainly bronzy, even including the pronotal collar. Gaster dull bronzy, the first large tergite blue-green, sometimes tinged with red-violet, in about basal two-thirds or more, sometimes almost wholly bright coloured, with only a rather large, median apical mark bronzy. Legs dark green, the tibiae sometimes pale at extreme apex, the tarsi stramineous, with the apical segment pale brown.

Redescribed from the following. SULAWESI (= Celebes): Macassar, 4 ♀♀, 1959, *ex* pupa *Aspidomorpha miliaris* Fabricius (Col., Cassididae) (*J. M. Hutagalung*), (det. A. B. Gahan and B. D. Burks). KENYA: Ruiru, 4 ♀♀, 16.xii.1954, 3 ♀♀, 11.i.1955 *ex* pupa *Aspidomorpha parummaculata* Boheman (*D. J. McCrae*); UGANDA: Kampala, 16 ♀♀, xi.1929, '*ex* Cassid pupa on sweet potato' (*H. Hargreaves*). TANZANIA: Amani, 35 ♀♀, 8.xii.1921, *ex* Cassidid on sweet potato (*A. H. Ritchie*). Males are present in all but the Uganda series and are copper-coloured.

This species was first drawn to my attention by Dr Burks, who organized the loan of the Macassar series. Simultaneous study of the African series satisfied me that I could regard them as belonging to the same species.

Dr Burks informed me that he and Mr Gahan had not seen the Australian types but had made the determination from literature. The most useful character mentioned in Girault's paper appears to me to be the host-record: Dr E. F. Riek informed me that the 'revised tables' referred to are almost certainly his manuscript notes to the family, which were completed in 1934 but not published.

I wished to have the identity of the species confirmed and also the sex of the type material checked, suspecting that Girault had mistaken this, since all male specimens available to me are copper-coloured. Accordingly I sent a copy of the above redescription, tracings of my figures of the female gaster, and 3 ♀♀, 2 ♂♂ from the Tanzanian series for deposit in the Australian National Collection. Dr Riek visited Brisbane and kindly replied as follows:

> 'I have examined the types of *Pediobius aspidomorphae*. There are two slide-mounted specimens. The two, crushed, bodies are on one slide and the heads and antennae on another. The slides are poor, with the bodies crushed and opaque. I can just distinguish that one body is that of a female. This is the slightly larger specimen. I think that the other one is probably also a female. The gaster is abbreviated at apex and of male form in both specimens. That of the larger specimen is about as large as the thorax.
>
> 'The only character that does not seem to fit is the petiole which is slightly wider than long (measurements taken over the narrowest parts). This may be due to some compression particularly as the thorax is crushed although I do not think that this is so.'

The European *P. epeus* (Walker) has the female gaster of the same form as in this species. The type, which I have examined, agrees with *aspidomorphae* in having the sculpture of the mesoscutum reticulate and strongly outstanding, though considerably less coarse. It differs notably as follows: pronotal collar rather long, little narrowed at sides: scutellum of normal convexity for the genus, finely longitudinally striate with weak inter-connecting ridges, the sculpture weaker in mid line: propodeum having submedian carinae adjacent at base, diverging slightly to about half way back, then at about 45° (Bouček, 1965, fig. 11, p. 21). Bouček compares *P. ulmi* (Erdös) with *epeus*, stating that in that species the smooth area of the scutellum extends forward in mid line.

The North American *P. lonchaeae* Burks, which has the same form of female gaster, shows much affinity with *epeus* in the above respects. However, the sculpture of the mesoscutum is coarser, more like that of *aspidomorphae*, and the propodeum has the submedian carinae well separated at base. The scutellum is relatively broader and a little flatter than in *epeus;* it has the sculpture rather strongly outstanding, mainly longitudinally striate in about basal half merging to slightly longitudinally reticulate, smooth behind (Burks, 1966, fig. 4, p. 38). The anterior angles of the mesoscutum are very prominent. I have examined a pair of paratypes.

## *Pediobius marjoriae* sp. n.

Head very broad, three times breadth of its median length, scarcely emarginate in front but broadly and rather deeply so behind. Frontovertex about two and two-thirds times the dorsal breadth of an eye and about 1·8 times breadth of its median length, with ocelli in a very obtuse triangle, the lateral about one and a half times their diameter from orbital margin. Head shining all over, without distinct sculpture even on sides of upper face. Eyes not distinctly hairy (× 100).

Antenna having scape narrow, very little expanded in middle, about seven times length of its greatest breadth, but pedicellus rather swollen, twice length of its greatest breadth: funicle not broadened in side view, the first segment over, the third normally nearly twice length of its greatest breadth, the segments strongly petiolate at apex, relatively sparsely beset with outstanding hairs, that mostly are much longer than the breadth of the segment that bears them.

Pronotal collar having sides distinctly broadened, weakly emarginate. Notauli moderately deeply impressed anteriorly then very weakly so: notaular pits shallow, scarcely defined, bearing the main seta about half way forward: mesoscutum having reticulation wide-meshed in middle, less so at sides, tending to be longitudinal behind the middle, and very fine in the notaular pits: hind margin scarcely sinuate. Scutellum rather strongly convex, strongly longitudinally striate anteriorly, merging to reticulate in about hinder half, the bristles comparatively short, evidently shorter than the part behind them. Propodeum having submedian carinae almost straight and gently divergent in greatest part, more strongly so near apex but at much less than 45°, and without or with only a trace of a median carina: nucha sharply margined at sides, moderately emarginate at apex: spiracles small, very short-oval, the spiracular area, seen from above, produced into a small tooth above the hind coxa.

Petiolar segment about one and a half times as broad basally as long, with anterior margin only moderately raised in middle, finely reticulate behind, more coarsely and irregularly so and with some short longitudinal ridges anteriorly. Gaster beyond petiole pointed, sometimes strongly so, the first large tergite usually somewhat less than half its length, almost smooth above, the following very finely reticulate to trans-striate, the pilosity comparatively long and sparse.

Fore wing trichiation dense. Hind tibial spur straight, not nearly reaching apex of corresponding metatarsus, which is relatively elongate.

Frontovertex and hinder genae blue-black with weak, brighter reflection: upper and lower face and clypeus blue-green, with strong coppery to bright brassy reflection. Antennae having scape stramineous, with very weak metallic reflection, and pedicellus and flagellum bright coppery to bronzy. Thorax in greater part and sides of propodeum a very dull green overspread with blackish, but propleura and an upper longitudinal streak on mesopleura a moderately bright green. Gaster dark bronzy, the first large tergite blue-breen in about basal two-thirds or more. Legs blue-green, the coxae often darker at base, the femora and tibiae often with dull brassy to bronzy reflection, the tibiae pale at extreme apex, the tarsi pale stramineous, with the apical segment slightly darkened.

Holotype ♀. UGANDA: Moniko, vii.1941, 'primary ex cocoon of ant (? *Acantholepis* sp.)' (*T. H. C. Taylor*) (BMNH).

Paratypes. UGANDA: 11 ♀♀, same data as holotype. No males are present in the series.

Named for my wife in thankfulness for her unfailing interest and support.

## ***Pediobius coffeicola*** (Ferrière)

(Pl. 2, fig. 3)

*Pleurotropis coffeicola* Ferrière, 1936 : 483–4, 489–91. Holotype ♀, TANZANIA: Arusha (BMNH) [examined].
*Pleurotropis coffeicola* Ferrière; Masi, 1940 : 301–3.
*Pediobius coffeicola* Ferrière; Kerrich, 1970 : 328–9.

Head, seen from above, about two and a half times breadth of its median length. Frontovertex about or nearly twice the dorsal breadth of an eye and about as broad as to one-quarter broader than its median length, with ocelli in about a right-angled triangle; with reticulate microsculpture in well-developed specimens almost throughout, just clearly distinct × 65. Sides of upper face finely reticulate. Eyes extending well below level of toruli, sparsely and finely hairy (× 65).

Antenna having scape about five and pedicellus about one and a half times length of its greatest breadth: flagellum in coffee-associated form slightly broadened in side view, the first segment about one and a third times length of its greatest breadth and third slightly longer than broad, the segments shortly petiolate at apex; but in oil palm associated form relatively slender, with the segments longer petiolate.

Pronotum having lateral angles prominent, as in *saulius* (Walker) (Bouček, 1965, pp. 35–36), the collar strongly contracted and rounded at sides behind its sharp anterior margin, weakly longitudinally striate in middle. Notauli strongly impressed anteriorly: notaular pits bearing a deep longitudinal impression, having a very sharp anterior margin and bearing the main seta near inner corner almost immediately behind this margin: mid lobe of mesoscutum anteriorly moderately to rather coarsely reticulate, merging to moderately to very strongly striate between the notaular pits, the parapsides finely concentrically striate; hind margin rather weakly to moderately sinuate. Scutellum regularly, moderately to rather strongly longitudinally striate, the striation merging to reticulation shortly before the smooth apical margin. Propodeum having submedian carinae well separated at base, curving inward very briefly and then curving outward, diverging at about or less, sometimes much less, than 45° and seldom with any indication of a median carina; nucha short, almost truncate at apex: spiracles very small, oval, the spiracular area, seen from above, weakly and bluntly produced above the hind coxa.

Petiolar segment broader at base than long, with anterior margin strongly raised in middle, finely reticulate, with longitudinal ridges present at sides but absent or very weak and incomplete above. First large tergite about half length of gaster beyond petiole, with very slight surface irregularity on the bronzy part, the following tergites very finely to extremely finely reticulate, with the apical margins smooth.

Hind tibial spur short and almost straight, not or hardly reaching apex of corresponding metatarsus.

Frontovertex medium green, often merging before ocelli to royal blue or red-violet, or sometimes a very dark green to steely blue, with bronzy extending from upper face: lower face dull green to steely blue and upper face bronzy. Antennae blue-green. Thorax and propodeum medium green to blue-green, sometimes merging to blue or red-violet, the thorax often infused to a very varying extent with bronzy, sometimes very largely bronzy. Gaster dull bronzy, the first large tergite blue-green, sometimes tinged with red-violet, in about basal half or more extensively, often almost wholly so except for a large median mark in about apical half, the following tergites mostly with narrow, blue-green apical margins and sometimes tinged blue-green at sides. Legs dark blue-green, the hind coxae sometimes almost black, the tarsi stramineous, with the apical segment fuscous.

Material studied. TANZANIA, UGANDA, KENYA, holotype and numerous paratypes *ex Leucoptera* spp. mining in coffee (see Ferrière, 1936). KENYA, Kiambu, 1 ♀, 16.ix.1953, *ex Leucoptera caffeina* Washbourn (*D. J. McCrae*). GHANA, IVORY COAST: ♀♀, *ex Coelaenomenodera elaidis* Maulik (Hispidae) on oil palm (see Kerrich, 1970); ZAIRE: Nioka, ♀, 1934 (*J. V. Leroy*).

BIOLOGY. Reared both as primary and hyperparasite of lepidopterous leaf-miners in coffee in East Africa and of the Hispid leaf-miner in oil palm in West Africa (see Kerrich, 1970). See also Le Pelley (1968).

### ***Pediobius clinognathus*** (Waterston) **comb. n.**

(Pl. 2, fig. 4; Text-fig. 3)

*Pleurotropis clinognathus* Waterston, 1915 : 345, 348, 350–3, 357. LECTOTYPE ♀, NIGERIA: Ibadan (BMNH), here designated [examined].

*Pleurotropis clinognathus* Waterston; Masi, 1940 : 301–2.

*Pleurotropis macrognathus* Risbec, 1958 : 68, 72–5. Holotype ♀, ZAIRE: Haut Uele, Paulis (MRAC, Tervuren). **Syn. n.**

Head, seen from above, rather deeply emarginate in front and behind, thus over two and a half to nearly three times breadth of its median length. Frontovertex twice or nearly twice the dorsal breadth of an eye and one and a quarter to nearly one and a half times breadth of its median length, with ocelli in about a right-angled or very slightly obtuse triangle: with microsculpture distinct × 45 almost throughout, in a regular reticulation on inter-ocellar area but otherwise irregular. Sides of upper face rather finely reticulate, the pattern transverse in part; lower face and clypeus uncommonly broad and flat for the genus (Text-fig. 3), markedly shining. Eyes in facial view very weakly emarginate, extending a little below level of toruli, coarsely and rather densely hairy. Mandibles elongate, sickle-shaped, with the lower tooth much longer and stronger than the upper (Waterston, 1915, fig. 5e).

Antenna (Waterston, 1915, fig. 2d) having scape about six times and pedicellus twice length of its greatest breadth: flagellum not broadened in side view, the first segment nearly twice length of its greatest breadth, the third a little longer than broad, the segments shortly but distinctly petiolate at apex [the representation in Risbec's figures should be ignored].

Pronotal collar almost parallel-sided, bearing some very weak reticulation behind its weak anterior margin, its posterior margin more deeply emarginate in front of mid lobe of mesoscutum. Notauli sharply impressed: notaular pits rather shallow but very conspicuous, margined anteriorly by sharp continuations of the notauli and on inner side by converging striae, which leave a comparatively narrow separation before the scutellum, bearing the main seta about two-fifths the way forward and at a greater distance from the inner margin: reticulation rather coarse on mid lobe of mesoscutum anteriorly and on parapsides, merging to longitudinal striation, the sculpture weaker in the notaular pits: hind margin rather strongly sinuate. Scutellum longitudinally elongate-reticulate. Propodeum (Waterston, 1915, fig. 3), having submedian carinae rather close together at base, diverging weakly and almost rectilinearly in more than basal half, then more strongly but at much less than 45°, and with some indication of a median carina: nucha narrowly and deeply emarginate at apex: spiracles sub-circular, about twice their own diameter from margin of metanotum, the spiracular area, seen from above, produced into a large rounded lobe above the hind coxa.

Petiolar segment much broader at base than long, with anterior margin hardly raised, very finely reticulate, with longitudinal ridges above and at sides weak and incomplete. Remainder of gaster very short-oval, much shorter than thorax plus propodeum and not greatly longer than broad: first large tergite rather over half its length, almost smooth, the following tergites very finely to extremely finely reticulate.

Hind tibial spur straight, not reaching apex of corresponding metatarsus.

Frontovertex sea-green, merging to red-violet: upper and lower face dark blue-green, the upper face in greater or lesser part bronzy. Antennae testaceous, with some metallic green darkening on scape, and pedicellus and flagellum largely metallic green, especially above. Pronotal collar, scutellum and propodeum mainly dark blue-green to blue: mesoscutum dark blue-green, mainly overlaid with bronzy. Gaster dull bronzy, the first large tergite wholly or mainly blue-green and red-violet. Legs having coxae, trochanters and femora mainly blue-green, the trochanterelli paler, the tibiae testaceous to dull stramineous, with slight metallic green darkening on fore and mid tibiae above, and more on hind tibiae, the tarsi dull stramineous, with only the extreme apex infuscate.

Redescribed from the following. GHANA: Aburi, numerous ♀♀, 1912–13, *ex Synagris cornuta* Fabricius (*W. A. Patterson*) ('paratypes'). NIGERIA: Ibadan, numerous ♀♀, em. 2.ii.1914 (*W. A. Lamborn*) (syntypes). ZAIRE: Haut Uele, Paulis, 2 ♀♀, vii.1947 (*P. G. L. Benoit*) (paratypes of *macrognathus* Risbec). From among the female syntypes from Ibadan, one specimen is here selected as lectotype and has been so labelled.

*P. clinognathus* Waterston has been separated from other African species in dichotomous keys upon the form of the mandibles and the brownish tint of the wings, whereas Risbec separated *macrognathus* upon a rosy wing tint. In fact the brownish tint is very faint, and the rosy and other interference colours can be seen in the Waterston specimens by viewing them at the appropriate angle.

Risbec stated that the holotype, allotype and paratypes were in the Musée Royal, Tervuren, but did not cite any male specimen. Dr J. Decelle has accounted for all specimens except three, which Risbec may have retained, and informs me by letter that all are female, so no Risbec allotype may exist.

Dr P. G. L. Benoit is unable, at this time, to trace his records from that date: it may be presumed that his twenty specimens were either reared from the nest of a social wasp or taken on the windows of a house, under the eaves of which such a wasp was nesting.

### *Pediobius arcuatus* sp. n.

Head, seen from above, rather deeply emarginate in front and deeply so behind, about three times breadth of its median length which in consequence is relatively short. Frontovertex about one and a half times breadth of its median length and twice or more the dorsal breadth of an eye, with ocelli in about or, more usually less than, a right-angled triangle, relatively large, the lateral little more than their own diameter from orbital margin. Frontovertex having, on inter-ocellar area, reticulation that is very fine but dense and distinct, elsewhere shining, with sculpture indistinct; delimited from upper face by a sharp transverse carina, which is much nearer the median ocellus than the length of that ocellus, and which does not quite reach the eyes. Upper face shining and with sculpture indistinct above the frontal fork, the arms of which converge at about a right, or only slightly obtuse, angle, at sides rather finely and for the most part decidedly transversely reticulate. Eyes rather strongly and moderately densely hairy.

Antenna having scape five times and pedicellus over twice length of its greatest breadth: funicle distinctly broadened in side view, the first segment nearly twice length of its greatest breadth, the third one-fifth longer than its greatest breadth, the segments shortly petiolate at apex: club excluding terminal spine equal in length to first funicle segment.

Pronotal collar having sides slightly narrowed and sharply emarginate. Notauli fine, sharply impressed, running to notaular pits that are of moderate depth but not sharply defined, and which bear the main seta less than a third the way forward: mesoscutum with a more or less developed median longitudinal impression in about hinder half: mesoscutum having reticulation irregular, varying from moderately wide-meshed, especially on about middle of mid lobe, to very fine: hind margin weakly sinuate. Scutellum shining, finely longitudinally striate almost throughout, not clearly more weakly so in mid line. Propodeum having submedian carinae strongly raised basally, bowed inward to middle then outward again, diverging behind at about 45°, and without or with only a trace of a median carina; not quite smooth dorsally but in large part with indefinite sculpture visible × 65: nucha rather large, having carinae that are irregular but often of moderate strength, rather deeply emarginate at apex: spiracles elongate-oval, the spiracular area, seen from above, produced into a sharp or very sharp tooth above the hind coxa.

Petiolar segment about one and a half times as broad basally as long, with anterior margin very little raised, strongly decurved in side view, rather finely reticulate, longitudinally keeled at sides but not above. Gaster beyond petiole relatively elongate and pointed, the first large tergite somewhat less than half its length, almost smooth above, the second to fourth delicately and finely reticulate with broad, smooth margins, the following finely reticulate to trans-striate, the pilosity relatively strong and outstanding.

Basalis of fore wing bearing several hairs, usually arranged in two rows. Hind tibial spur slightly curved, extending to or only just beyond apex of corresponding metatarsus.

Head blue-green, with brassy to bronzy reflection, in part blue-black, especially on frontovertex and malar region. Antennae having scape stramineous, and pedicellus and flagellum dull blue-green, the pedicellus pale beneath. Thorax and sides of propodeum very dull green, with infusion of blue-black. Propodeum above bright blue-green, with infusion of royal blue to red-violet. Gaster very dark bronzy, the first large tergite in more than basal half strongly blue-green, usually with infusion of blue and red-violet. Legs blue-green to dull blue, the femora pale at extreme apex, the tibiae and tarsi pale testaceous to dull stramineous, the tarsi hardly darkened at apex.

Holotype ♀. UGANDA: Kawanda, ix.1942, 'secondary *ex* cocoons under *Dasychira goodii* Holland on *Ficus*' (*T. H. C. Taylor*) (BMNH).

Paratypes. UGANDA, 10 ♀♀, same data as holotype. No males are present in the series.

## ***Pediobius homoeus*** (Waterston) **comb. n.**

*Pleurotropis homoea* Waterston, 1915 : 345–6, 353, 356–8. LECTOTYPE ♀, MALAWI: Zomba (BMNH), here designated [examined].
*Pleurotropis homoea* Waterston; Masi, 1940 : 301–3.

Head, seen from above, about 2·3 times breadth of its median length. Frontovertex about twice the dorsal breadth of an eye and one-third broader than its median length, with ocelli in a very distinctly acute triangle: weakly reticulate throughout, but the reticulation distinct × 45. Sides of upper face moderately reticulate. Eyes rather sparsely and obscurely hairy.

Antenna (Waterston, 1915, fig. 2f) having scape about four times length of its greatest breadth: funicle strongly broadened in side view, the first segment about one and three-quarter times length of its greatest breadth, the second a little longer than broad, the third distinctly broader than long, and club distinctly broader than the third funicle segment.

Pronotal collar weakly rounded at sides; not quite smooth, but with sculpture very weak and indefinite. Notauli sharply impressed and moderately strong, running to the notaular pits which are ill-defined and rather shallow, and bear the main seta about one-third the way forward: mesoscutum finely transversely reticulate anteriorly, merging to finely longitudinally striate-reticulate between the notaular pits, more strongly reticulate in and beside them: hind margin moderately sinuate. Scutellum longitudinally striate-reticulate at sides, merging to reticulate behind, having a median band of moderate breadth finely but very distinctly reticulate, (*pace* Waterston) not smooth, but the sculpture greatly exaggerated in Terzi's drawing. Propodeum (Waterston, 1915, fig. 10) having submedian carinae straight and gently divergent in greater part, more strongly divergent but at much less than 45° in about apical third, and with a median carina or strong indication of such; not quite smooth dorsally but with indefinite sculpture obvious × 65 and with very fine reticulation within the median area: nucha rather large, having sharp carinae running back from the submedian carinae, rather deeply emarginate at apex: spiracles elongate-oval, the spiracular area, seen from above, produced into a very sharp tooth above the hind coxa.

Petiolar segment a little longer than its breadth at extreme base, finely reticulate, with longitudinal ridges of moderate strength but irregular and incomplete. Gaster beyond petiole rather broad oval, the first large tergite about two-thirds its length, delicately reticulate on the bronzy part, the following tergites very finely reticulate to trans-striate.

Hind tibial spur curved, extending well beyond apex of corresponding metatarsus.

Head dark blue-green to blackish blue with some brighter reflection, the upper face more bronzy. Antennae blue-green. Mesothorax dark blue-green with some brighter reflection, the pleura and also sides of propodeum in large part bronzy: propodeum above and pronotal collar a much brighter green. Gaster bronzy, the first large tergite blue-green in about basal three-fifths. Legs dark blue-green, the tarsi stramineous with the apical segment fuscous.

The species was described from a series of 10 ♀♀, 2 ♂♂, from MALAWI, Zomba, reared from the stalk-borer *Busseola fusca* Hampson by E. Ballard. I have not determined any reared series of this species during my service with the Commonwealth Institute of Entomology, although I have received *P. furvum* (Gahan) reared from *Busseola* and other stalk-borers many times.

In the collection of the British Museum (Natural History) are card mounts of seven ♀♀, two lacking the head, and one ♂, five slides of dissections of the ♀ and two of the ♂. I select as lectotype an undamaged female specimen mounted half on its side, on which the dorsal and left lateral surfaces can be well, and the facial and ventral surfaces fairly well, seen. The remaining specimens are paratypes. The above redescription has been made from the lectotype and card-mounted paratypes.

Despite Waterston's key character and description, I find the mid anterior region of the scutellum not smooth, but to have the reticulation, though very decidedly finer, distinctly raised.

### ***Pediobius anastati*** (Crawford) **comb. n.**

(Pl. 3, fig. 5)

*Pleurotropis anastati* Crawford, 1913 : 254–5. Holotype ♀, MALI: Koulikoro (USNM, Washington).

*Pleurotropis violaceus* Waterston, 1915 : 345, 362. Holotype ♂, MALAWI: Zomba (BMNH) [examined]. **Syn. n.**

Head considerably broader than thorax, comparatively strongly emarginate in front, hence about three times breadth of its median length. Frontovertex more than twice the dorsal breadth of an eye and about twice breadth of its median length, comparatively strongly emarginate in front, with ocelli in a very distinctly obtuse triangle; finely reticulate, the meshes becoming transverse before the ocelli. Reticulation on sides of upper face rather fine. Eyes very sparsely and obscurely hairy.

Antenna having scape about three and a half times length of its greatest breadth: funicle strongly broadened in side view, the first segment a little longer than broad, the second and third strongly transverse, the segments strongly petiolate at apex, and club a little broader than the third funicle segment.

Pronotal collar almost straight-sided, with hind margin rather deeply emarginate and consequently relatively short in mid line, finely but very distinctly reticulate. Notauli moderately impressed anteriorly but obscure behind this: notaular pits shallow and ill-defined, bearing the main seta about one-third the way forward: mesoscutum regularly and finely reticulate: hind margin weakly to moderately sinuate. Scutellum longitudinally reticulate or striate-reticulate, merging to longitudinally reticulate behind; having a median band of moderate breadth finely reticulate, but the sculpture very distinct throughout. Propodeum having submedian carinae curving gently outward and with a fine median carina: nucha short, rather deeply emarginate at apex: spiracles short to moderately elongate-oval, the spiracular area, which bears very fine reticulation, produced into about a right-angled tooth above the hind coxa.

Petiolar segment transverse, very finely reticulate, with rather weak longitudinal ridges at sides but not above. Gaster beyond petiole broad-oval, the first large tergite just over half its length, with median reticulation on apical half extremely delicate, just comfortably discernible × 65, the following tergites very finely reticulate, with smooth apical margins.

Hind tibial spur strongly curved, extending to about middle of second tarsal segment.

Frontovertex blue-green: upper and lower face brassy green. Antennae blue-green, with some brassy to bronzy reflections on the flagellum. Thorax dull green, more or less overspread with dull bronzy: propodeum a brighter blue-green. First large tergite blackish brown, with a trace of bluish reflection near base: remainder of gaster more bronzy, occasionally with green reflection. Legs dark blue-green, the hind tibiae tending to be brighter, the tarsi dull stramineous, with the apical segment fuscous.

Through the cooperation of Dr B. D. Burks I have been able to study 1 ♀ and 1 ♂ of Crawford's paratypes. The Waterston name caused some difficulty. He gave separate descriptions of female and male, which at first I considered to be separate species, but he selected the male as type. In the collection there was placed a series of specimens from Senegal, which again was a mixed series but which contained 1 ♂ which I could determine as *violaceus* (Waterston) and 1 ♀ which I considered conspecific but which lacked the head. Comparison with Crawford's paratypes confirmed this association. Finally, a good series of specimens from former Eritrea, all female, in the partly sorted material of the CIE, was recognised as belonging to the same species.

Redescribed from the following. MALI: 1 ♀, Crawford paratype. SENEGAL: Bambey, 1 ♀, *ex* eggs on 'cade' (*J. Risbec*); ETHIOPIA: former Eritrea, Asmara, 14 ♀♀, 4.vii.1948, *ex* eggs of *Pachypasa* sp. (*G. de Lotto*). Waterston's male holotype from MALAWI.

The regular reticulation of the mesoscutum is a distinctive character of this species: through it I recognize the featureless female runt studied by Waterston as belonging here.

The male has the frontovertex for the most part bright red-violet and a transverse patch of the same colour beside the mandibular base: the antennal flagellum is also tinged with the same colour in the specimens in the British Museum (Natural History) though not in the paratype. Masi (1940) presumably placed *violaceus* in his key from Waterston's description of the female specimen.

### ***Pediobius praeveniens* sp. n.**

Head, seen from above, about two and three-quarter times breadth of its median length. Frontovertex rather less than twice the dorsal breadth of an eye and distinctly broader than its median length, with ocelli in a strongly acute triangle, the lateral not much less than their longer diameter from occipital margin, which is sharp to not much below level of top of eye; on inter-ocellar area and beside and behind the lateral ocelli rather dull, with reticulate microsculpture very distinct × 65 and comparatively outstanding, but before the ocelli shining and with sculpture less distinct. Reticulation on sides of upper face rather fine, diagonally patterned. Clypeus with a pair of lateral teeth and a small median raised projection. Eyes very weakly and sparsely hairy (× 65).

Antenna having scape over four times length of its greatest breadth: funicle moderately broadened in side view, the first segment about one and a third times length of its greatest breadth, the second a little longer than broad, and third decidedly broader than long, and basal club longer and broader than third funicle segment.

Pronotal collar almost straight-sided. Mesoscutum almost flat except at sides. Notauli in anterior half fine, sharply impressed, leading to notaular pits that are rather shallow and ill-defined, diagonally directed, and bear the main seta about two-fifths the way forward: mesoscutum with a trace of a median impression, rather coarsely reticulate in greater part, merging to longitudinally reticulate behind, more finely so along anterior margin and in notaular pits: hind margin weakly sinuate. Scutellum weakly convex, decidedly transverse, rather coarsely longitudinally striate, with about 17 striae above, merging to longitudinally reticulate on hinder corners. Propodeum having submedian carinae rather strongly divergent, curving gently outward, and with a rather strong median carina: nucha strongly convex, moderately emarginate at apex: spiracles very small, short-oval, much more than their longer diameter from margin of metanotum, the spiracular area, seen from above, weakly and bluntly produced above the hind coxa.

Petiolar segment slightly transverse, with anterior margin scarcely raised, finely reticulate, without longitudinal ridges above. Gaster beyond petiole relatively elongate, apically acute, the first large tergite less than half its length, the first two virtually smooth, the following tergites very to extremely finely and delicately reticulate.

Hind tibial spur fine, reaching well beyond apex of corresponding metatarsus.

Frontovertex blackish bronzy merging to dark blue-green: upper and lower face dark blue-green with some brassy reflection. Antennae having scape pale brown, with only slight darkening, and pedicellus and flagellum pale brown beneath, blue-green above. Pronotum bronzy: mesoscutum and scutellum blue-green, with bronzy reflection on scutum especially in front, on sides and on axillae: propodeum above a bright blue-green. Gaster pale bronzy, the first large tergite blue-green to peacock-blue and red-violet in about basal three-quarters. Coxae blue-green: trochanters, femora and tibiae testaceous, with only slight metallic colouring near apex of hind femora: tarsi stramineous, with the apical segment brown.

Holotype ♀. UGANDA: Kampala, 1.iv.1930, 'egg parasite of *Aspidomorpha quadrimaculata* Olivier' (*H. Hargreaves*) (BMNH).

Paratypes. UGANDA: 20 ♀♀, same data as holotype. KENYA: near Mombasa, 4 ♀♀, 25.ix.1967, *ex* eggs of *Aspidomorpha puncticosta* Boheman (*D. J. Greathead*). Males are present in both series.

## ***Pediobius modestus*** (Masi) **comb. n.**

*Pleurotropis modesta* Masi, 1940 : 301–7. Holotype ♀, SOMALI REPUBLIC: Jowhar (= Villagio Duca degli Abruzzi) (MCSN, Genoa) [examined].

? *Pleurotropis pachyceps* Masi, 1940 : 301–5. Unique holotype lost.

[? *Pleurotropis violaceus* Waterston *pro parte*; Risbec, 1951 : 51–3, 63–5. Misidentification.]

*Pleurotropis violaceus* Waterston var. *manticida* Risbec, 1958 : 68–72 : 87. Holotype ♀, ZAIRE: Kisangani(=Stanleyville) (MRAC, Tervuren). **Syn. n.**

Head, seen from above, little more than twice as broad as its median length. Frontovertex less than twice the dorsal breadth of an eye and about as broad as its median length, with ocelli in a moderately acute triangle, the lateral quite their longer diameter from occipital margin, which is sharp to below level of middle of eye; dull, rather weakly reticulate but the reticulations very distinct × 45 (condition comparable to that in *afronigripes* nom. n. but finer). Reticulation on sides of upper face fine, on lower face and clypeus hardly distinct. Clypeus broadly almost truncate at apex. Eyes not distinctly hairy (× 100).

Antenna having scape about four times length of its greatest breadth: funicle moderately broadened in side view, in well-developed specimens having first segment about one and a third times length of its greatest breadth, the second a little and third decidedly broader than long, and basal club about as broad as third funicle segment: in smaller specimens the flagellar segments are relatively shorter.

Pronotum finely but very distinctly reticulate, about as on frontovertex, the anterior margin of the collar very weakly raised and not delimiting a sharp difference of sculpture, the sides of the collar sharply contracted. Notauli in anterior half fine, sharply impressed, leading to notaular pits which are shallow and ill-defined and bear the main seta rather near inner corner; mesoscutum rather finely reticulate in greater part, more coarsely so on anterior half of median third: hind margin rather weakly to moderately sinuate. Scutellum very weakly convex, finely longitudinally reticulate in middle on about anterior half, less finely so posteriorly, striate-reticulate at sides. Propodeum having a relatively strong median carina, having submedian carinae rather weakly divergent in about basal half, then much more strongly divergent, but curving inward around the nucha, which is very short, deeply emarginate at apex: spiracles small, oval, the spiracular area, seen from above, almost rectangularly produced above the hind coxa.

Petiolar segment about as long as its basal breadth, with anterior margin distinctly, sharply but not strongly raised, finely to very finely reticulate and with some irregular longitudinal ridges. Gaster beyond petiole oval, the first large tergite about three-fifths its length, virtually smooth, the following tergites very to extremely finely and delicately reticulate.

Hind tibial spur fine, not or hardly reaching apex of corresponding metatarsus.

Frontovertex dark blue-green, the ridges of the reticulations blackish bronzy: upper and lower face dark blue-green with some bronzy reflection. Antennae pale brown, with greater or lesser amount of metallic green colouring. Thorax above, including pronotal collar, blackish bronzy to very dark green, the ridges of the reticulations dark, the scutellum sometimes coppery at apex: propodeum a rather bright blue-green. Gaster blackish brown, with some blue-green to blue or red-violet reflection at base of first large tergite, and occasionally more extensively. Legs dark blue-green, the tibiae sometimes pale at apex, the tarsi dull stramineous, with the apical segment brown.

Redescribed from the following. ETHIOPIA: former Eritrea, Asmara, 5 ♀♀, 23.v.1946, '*ex* egg-pod of a Mantoidea sp.' (*G. Jannone*). SOMALI REPUBLIC: Jowhar (= Villagio Duca degli Abruzzi), unique holotype ♀, 1930 (no biological data) (*G. Russo*). TANZANIA: Mpala, ♀, viii.1953, submitted together with Mantid ootheca (*H. Bomàns*); Ukinguru, 2 ♀♀, 19.iii.1959, '*ex* Mantid eggs' (*I. A. D. Robertson*). SOUTH AFRICA: Pretoria, ♀, 12.ii.1957, '*ex* small Mantid egg-case no. 4' (*P. R. zur Strassen*); ZAIRE: Basoko, 3 ♀♀, v.1948, 'parasite de oothèque de Mantidae' (*P. G. L. Benoit*) (paratypes from same reared series as holotype of 'var. *manticida*'); Yahuma, Kisangani, 4 ♀♀, xii.1948, 'parasite de oothèque de Mantidae' (*P. G. L. Benoit*) (paratypes of 'var. *manticida*' not from same series as holotype); Lusambo, 7 ♀♀, 1922, 'parasite de oothèque de Mante' (*J. Ghesquière*); Kivu, Uvina, 2 ♀♀, 3.i.1955, 'dans oothèque de mante' (*G. Marlier*). GHANA: Tafo, 13 ♀♀, 25.v.1945, '*ex* Mantid egg-mass' (*F. A. Squires*). IVORY COAST: Bingerville, 7 ♀♀, iv.1962, 'éclos d'oothèque de mante' (*J. Decelle*). SENEGAL: Bambey, 34 ♀♀, 1939, '*ex* eggs of Mantis' (*J. Risbec*).

Males are present in most of the series. The specimens in the series captured by J. Ghesquière and J. Decelle, located in MRAC, Tervuren are very numerous. Some paratypes of var. *manticida* Risbec, from the Basoko series, are also located in ORSTOM, mounted on two glass slides.

The unique holotype of *modestus* (Masi) has been compared directly with the series from Ethiopia (former Eritrea), Ghana and Senegal, and a specimen from each of these series has been presented to MCSN, Genoa.

Unfortunately the unique type-specimen of *pachyceps* (Masi) has been knocked off its mount, except for one leg, probably the right mid leg, and has been lost: the mount is labelled 'perduto' in Masi's writing. Despite appearances to the contrary that would be derived from Masi's paper, I think it was possibly another specimen of *modestus* (Masi) for the following reasons. It was recorded as reared from a Mantid ootheca, and I recognise only one species reared from such host in Africa. Specimens compared with the type of *modesta* have the head more strongly narrowed behind the eyes than as represented in Masi's paper (fig. 14a), and the petiolar segment, viewed directly from above, has been measured as being about as long as basally broad, though it more resembles Masi's fig. 15 if viewed obliquely. Masi's description of the nucha of *pachyceps* as not apically emarginate (p. 303) might have been due to an error of observation, which is often difficult especially in a single specimen, cf. his fig. 13b. He described the ocelli of *pachyceps* as being in an equilateral triangle, though they do not appear so in the plane in which his fig. 13a was drawn; and he described the sculpture of the scutellum as being merely less distinct in the middle (p. 305), though from his fig. 13b one would have deduced that the species was among those with a broad median band smooth or almost so.

Examination of paratypes of Risbec's 'var. *manticida*' (1958), including some from the same reared series as the holotype, has enabled me to establish the synonymy of this name. I believe Risbec's earlier description (1951 : 63–5, including figs 57–9) to refer to this species; but I have not examined the material reared from eggs of *Sphodromantis* and do not think the more numerous material from the same locality, submitted to the CIE and determined generically prior to autumn 1940, was from the same series. Dr J. R. Steffan confirms that 'souche', used by Risbec (1958), is a word of imprecise meaning: though most usually applied in biology to a strain, it clearly does not have that connotation there. It seems likely that the material recorded by Risbec (1951) and placed as *violaceus* (Waterston) from Ivory Coast, Abengourou, was not misidentified.

This and the known Asiatic species reared from Mantid oothecae are quite distinct: see pp. 173–174 below, on the latter of which the main differences are tabulated.

### ***Pediobius hirtellus*** (Masi) **comb. n.**

*Pleurotropis hirtella* Masi, 1940 : 301–2, 307–9. Holotype ♀, SOMALI REPUBLIC: Jowhar (= Villaggio Duca degli Abruzzi) (MCSN, Genoa) [examined].

Head, seen from above, about two and a third times breadth of its median length. Frontovertex about one and a half times the dorsal breadth of an eye and about as broad as its median length, with ocelli in an almost equilateral triangle, the lateral about their shorter diameter from occipital margin: dull, finely reticulate, the reticulation before and on the interocellar area quite distinct × 65, weaker beside and behind the lateral ocelli. Setae and the punctures from which they arise very prominent. Reticulation on sides of upper face fine, about as fine as on frontovertex, though more outstanding. Occiput very conspicuously hairy. Eyes strongly but sparsely hairy.

Antenna having scape almost parallel-sided, about four times length of its greatest breadth: funicle slightly broadened in side view, the first segment about one and a half times length of its greatest breadth, the second a little longer than broad, the third a little broader than long, and basal club about as broad as third funicle segment.

Pronotum having neck elongate, having collar strongly expanded at sides and then sharply contracted; very distinctly finely longitudinally striate-reticulate, with anterior margin sharply raised, narrowly emarginate in middle. Notauli in anterior half fine, sharply impressed, leading to longitudinal impressions in the notaular pits, these pits rather shallow, ill-defined on outer side, bearing the main seta in the impression about half the way forward: mesoscutum rather coarsely reticulate on mid lobe, merging to longitudinally reticulate on hinder half, very finely so on parapsides: hind margin broadly and weakly sinuate. Scutellum very weakly convex, regularly longitudinally striate-reticulate at sides, with a median band that is almost smooth but is less wide relatively than in *furvum* (Gahan): despite Masi's description I find this median band to be percurrent. Propodeum having upper surface extremely finely reticulate, having submedian carinae rather close together at base, weakly divergent in about basal two-thirds, then curved outward: nucha elongate, very finely reticulate: spiracles small, oval, more than their longer diameter from margin of metanotum, the spiracular area, seen from above, produced into a rather sharp tooth above the hind coxa. [It appears to me that Masi's illustrator was deceived in this case: I find, in the unique type, the apex of the nucha to be covered by the fore margin of the petiole, and I see the submedian carinae as closer and the spiracle as relatively smaller than as shown.]

Petiolar segment about as long as its basal breadth, finely reticulate, with some weak and very incomplete longitudinal ridges above. Gaster beyond petiole oval, the first large tergite about half its length, the first on about hinder half and the following tergites finely but very distinctly reticulate, though with smooth apical margins.

Frontovertex, upper and lower face very dark blue-green. Antennae brown, with weak metallic colouring above. Pronotal collar dark blue-green: mesoscutum and scutellum steely green to blackish: mesopleura very dark blue-green: propodeum above steely green, the nucha with some slight brighter reflection. Gaster blackish, with slight green to indigo reflection near base of first large tergite. Legs blue-green, the femora steely green, the tarsi dark stramineous, with the apical segment brown.

Redescribed from the unique holotype: SOMALI REPUBLIC.

I have failed to find further specimens of this species among the generically determined material received over the years by the CIE.

BIOLOGY. Taken on a cotton plant but biology unknown.

### *Pediobius furvum* (Gahan) **comb. n.**

*Pleurotropis furvum* Gahan, 1928 : 257. Holotype ♀, SUDAN: Khartoum (USNM, Washington).
*Pleurotropis furvum* Gahan; Masi, 1940 : 301–3.

Head, seen from above, broad, scarcely emarginate anteriorly, up to three times breadth of its median length. Frontovertex over twice the dorsal breadth of an eye and about one-third broader than its median length, with ocelli in a distinctly obtuse triangle; in greater part shining and almost smooth, there being no sculpture distinct × 65, on inter-ocellar area and behind and beside the lateral ocelli with some extremely fine reticulation. Sides of upper face reticulate, the ridges not strongly raised but the meshes comparatively coarse. Eyes sparsely but quite distinctly hairy (× 65).

Antenna having scape distinctly curved, about five times length of its greatest breadth: funicle evidently broadened in side view, the first segment about one and two-thirds times, the second about one and a half times length of its greatest breadth, the third distinctly longer than broad, the segments distinctly petiolate at apex.

Thorax very weakly convex, almost flat. Sides of pronotal collar very well rounded, slightly narrowed. Notauli sharply impressed, sometimes effaced beyond middle, when percurrent then running just outside of the relatively weak main seta, which arises rather near the scutellar suture, the notaular pits scarcely defined: mesoscutum weakly reticulate, often merging to longitudinally striate-reticulate on hinder half of mid lobe: hind margin broadly and weakly sinuate. Scutellum very weakly convex, weakly longitudinally striate-reticulate at sides, with a rather broad median band that is almost smooth. Propodeum having submedian carinae rather close at base, diverging gently in about basal half and then decidedly more strongly, without or with the merest trace of a median carina: nucha deeply emarginate at apex: spiracles almost circular, the spiracular area, seen from above, produced into a weak lobe above the hind coxa.

Petiolar segment much broader at base than long, with anterior margin only moderately raised, above with rather strong longitudinal ridges extending beyond middle, finely reticulate behind. Gaster beyond petiole broad to very broad-oval, about two-thirds as broad as long, the first large tergite about two-thirds its length, finely and delicately reticulate on the bronzy part, the following tergites with some very fine reticulation.

Hind tibial spur slightly curved, hardly reaching apex of corresponding metatarsus.

Head blue-black to dark blue-green, with bronzy reflections. Antennae dark blue-green. Thorax mostly blackish at sides, greenish black above, the propodeum above and usually the pronotal collar a much brighter green. Gaster in greater part dull brown with weak bronzy reflection, the first large tergite largely bright green in about basal half. Legs green, the tarsi pale stramineous, with the apical segment fuscous.

Redescribed from female specimens in series from SIERRA LEONE, GHANA, N. NIGERIA, RHODESIA, KENYA and SUDAN, including the three paratypes now standing in the collection of the British Museum (Natural History). Many males are also present.

The very weak convexity of the thorax has not been mentioned by other authors. Gahan's statement that the first tergite is not green is to be explained by his having examined the specimens presumably with a strong spotlight (cf. Kerrich, 1953, p. 800, 1967, p. 146). His description of the vertex as weakly sculptured all over is harder to understand, for before and beside the median ocellus and beside and behind the lateral ocelli I do not find the sculpture to be distinct × 100. Masi (1940) placed the species after the alternate in his key in which the scutellum is without a smooth median band.

BIOLOGY. This species has frequently been received as a parasite of the stalk-boring Lepidoptera, *Busseola*, *Sesamia* and *Chilo*. See also Mohyuddin & Greathead (1970, pp. 257, 270).

### *Pediobius telenomi* (Crawford) comb. n.

*Pleurotropis telenomi* Crawford, 1911 : 445. Holotype ♀, UGANDA: Entebbe (USNM, Washington).
*Pleurotropis telenomi* Crawford; Waterston, 1915 : 345, 362.
*Pleurotropis telenomi* Crawford; Masi, 1940 : 301–2.

Head, seen from above, moderately emarginate in front and rather deeply so behind, nearly three times breadth of its median length, the occipital carina strongly raised. Frontovertex about twice the dorsal breadth of an eye and one-half broader than its median length, with ocelli in a very decidedly obtuse triangle; in greater part shining and almost smooth, on interocellar area and behind and beside the lateral ocelli duller, though with reticulation scarcely distinct × 65. Sides of upper face with reticulation hardly distinct × 65. Eyes rather sparsely and obscurely hairy.

Antenna (Waterston, 1915, fig. 4c) having scape about four times length of its greatest breadth, almost parallel-sided in apical two-thirds: funicle very distinctly broadened in side view, having all segments quadrate or broader than long and shortly petiolate at apex.

Sides of pronotal collar slightly broadened in greater part, then sharply narrowed to hind margin. Notauli extremely fine, usually effaced in middle, the notaular pits ill-defined, rather diagonal, bearing the main seta about one-third the way forward: mesoscutum very finely reticulate, markedly less finely striate-reticulate in the notaular pits: hind margin moderately sinuate. Scutellum relatively strongly striate-reticulate at sides, with a median band of moderate breadth that extends for its whole length and is almost smooth. Propodeum rather strongly convex, having submedian carinae curving outward, diverging comparatively strongly, though at much less than 45°, with median carina normally complete and sharp: nucha small, well rounded at apex: spiracles short-oval, the spiracular area, seen from above, produced into a blunt lobe above the hind coxa.

Petiolar segment about quadrate, with anterior margin sharply but weakly raised, very finely reticulate. First large tergite not quite half length of gaster beyond petiole, smooth, the following tergites with sculpture just discernible × 65.

Hind tibial spur slightly curved, reaching just beyond apex of corresponding metatarsus. Length little more than 1 mm.

Frontovertex blue-black, with bronzy reflection: upper and lower face and cheeks green, with brassy or occasionally coppery reflection. Antennae and sides of thorax dull blue-green: pronotum above, often including the collar, and the mesoscutum blackish: scutellum dull brassy green: propodeum above bright blue-green. Gaster in greater part dark brown with bronzy reflection, the first large tergite more or less extensively blue-green to red-violet. Legs largely dull ochreous with only light metallic colouring, which is often stronger in part, especially on hind coxae.

UGANDA. Redescribed from 8 ♀ paratypes in collection of British Museum (Natural History), which contains two male paratypes also. The sculpture of the mesoscutum is appreciably stronger and coarser in the male than in the female.

BIOLOGY. Reared from eggs of *Anaphe infracta* Walsingham (Lep., Thaumatopoeidae) together with *Telenomus gowdeyi* Crawford (Scelionidae), presumably as secondary parasite through the *Telenomus* (see Crawford, 1911).

## ***Pediobius africanus*** (Waterston) **comb. n.**

(Text-fig. 8)

*Pleurotropis africanus* Waterston, 1915 : 345, 348, 353, 357, 360–2. LECTOTYPE ♀, MALAWI: Zomba (BMNH), here designated [examined].

*Pleurotropis africanus* Waterston; Masi, 1940 : 301–2.

Head, seen from above, two and two-thirds to three times breadth of its median length, comparatively strongly emarginate in front. Frontovertex about or nearly twice the dorsal breadth of an eye, and usually about one and a half times breadth of its median length, with ocelli in a slightly to distinctly obtuse triangle; weakly reticulate throughout, but the reticulation quite distinct × 45. Sides of upper face moderately reticulate. Eyes not evidently hairy (× 100).

Antenna having scape about three and a half times length of its greatest breadth: funicle moniliform, strongly broadened in side view, the first segment little longer than its greatest breadth, the second about quadrate, the third very distinctly broader than long, the segments strongly petiolate at apex, and club distinctly broader than the third funicle segment.

Pronotal collar rounded at sides and in greater part distinctly broadened; with reticulation very fine, sometimes indistinct. Notauli extremely fine, running to notaular pits that are of moderate depth, rather large, and bear the main seta about one-third the way forward: mesoscutum finely reticulate in middle to striate-reticulate: hind margin moderately sinuate. Scutellum longitudinally striate to striate-reticulate, narrowly in mid line with sculpture weaker, this median sculpture sometimes almost evanescent, especially behind, yet the median band not so smooth as Waterston seems to have implied, nor so broad as would appear from Terzi's drawing. Propodeum markedly convex, having submedian carinae almost straight and moderately divergent, and with a median carina: nucha strongly convex, sharply emarginate at apex: spiracles rather short-oval, the spiracular area, seen from above, produced into a rounded lobe above the hind coxa.

Petiolar segment a little shorter than its breadth at extreme base, very finely reticulate, with longitudinal ridges of moderate strength at sides but absent or very weak and incomplete above. Gaster beyond petiole broad-oval, the first large tergite about two-thirds its length, with median reticulation on apical half extremely delicate, just discernible × 65, the following tergites with some very fine reticulation.

Wings having cubital hair-row sparse immediately beyond basalis, then much denser, very distinctly arcuate. Hind tibial spur strongly curved, extending to about three-quarters length of second tarsal segment.

Length about 1·2 mm.

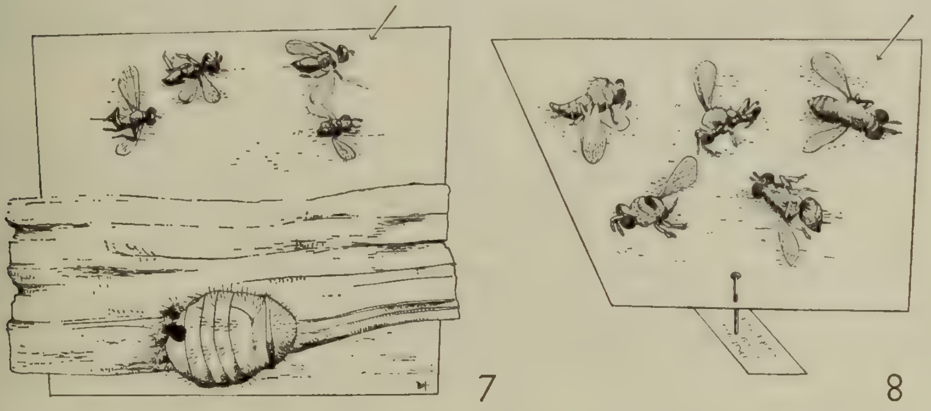
Frontovertex blackish bronzy, sometimes (as in type-series) very dark blue-green in the meshes: upper and lower face blue-green. Antennae blue-green. Thorax including pronotal collar blackish brown, the propodeum above and tegulae dark blue-green. Gaster blackish brown, with a trace of greenish or bluish reflection in about basal third. Legs dark blue-green, the tarsi dull stramineous, with the apical segment pale fuscous.

The syntypes stand in the collection of the British Museum (Natural History) as follows: 10 ♀♀, 2 ♂♂ mounted on card, and parts of 2 ♀♀ mounted on slides. On one card five specimens are mounted: I select as lectotype the female specimen in the top right-hand corner, numbered 3 on a diagram on a label.

Redescribed from the card-mounted female syntypes, MALAWI, and from the following. KENYA: Kiambu, 7 ♀♀, 1933, *ex* eggs of *Antestiopsis orbitalis bechuana* (Kirkaldy) (= *Antestia lineaticollis* Stål) (Hem., Pentatomidae) (*R. H. Le Pelley*); 3 ♂♂ also present in this Kenya series.

The head is decidedly broader than the thorax as stated by Waterston and Masi, but not so greatly more so than in *anastati* and *homoeus*. Masi (1940) placed this species after the first alternate of couplet 2 of his key, i.e. as having the scutellum with a smooth median band.

BIOLOGY. This species has been reared as a hyperparasite of eggs of *Antestiopsis* spp. (Pentatomidae) through *Trissolcus seychellensis* (Kieffer) and *Gryon* (= *Hadronotus*) *antestiae* (Dodd) (Scelionidae). 'The insect shows no continuing reaction to unparasitized eggs' and 'the minimum time the primary must have been present in the *Antestiopsis* egg to enable *Pediobius* to lay and successfully produce offspring is thought to be 7 days' (Le Pelley, 1968, pp. 271–2).



FIGS 7–8. Drawings illustrating the syntype mounts of 7, *P. foveolatus* ssp. *mediopunctatus* (Waterston) and 8, *P. africanus* (Waterston), the arrow indicating the lectotype in each case. Brian Hargreaves del.

## ***Pediobius vignae*** (Risbec) **comb. n.**

*Pleurotropis vignae* Risbec, 1951 : 51–3, 67. NEOTYPE ♀, NIGERIA: Ibadan (BMNH), here designated [examined].

Head, seen from above, about two and two-thirds times breadth of its median length. Frontovertex twice the dorsal breadth of an eye and rather less than one and a half times breadth of its median length, with ocelli in a decidedly acute to very slightly obtuse triangle; shining, but with fine, irregular reticulation evident × 65. Sides of upper face with reticulation rather weak, rather fine, diagonally directed: clypeus with extremely fine reticulation. Eyes rather sparsely hairy, just distinctly so × 25.

Antenna having scape slender, about six times length of its greatest breadth: funicle slightly broadened in side view, the first segment a little longer than broad, the second about quadrate, and third a little broader than long, and club scarcely broader than third funicle segment.

Pronotal collar almost straight-sided, slightly narrowed, with some weak reticulation and irregular longitudinal striation. Notauli extremely fine, running to notaular pits that are diagonally directed and moderately to rather deep, and bear the main seta about two-fifths the way forward: mesoscutum rather corasely longitudinally reticulate or irregularly striate in middle, more finely reticulate anteriorly and in the notaular pits, longitudinally striate beside the pits and moderately reticulate at sides: hind margin weakly to moderately sinuate. Scutellum longitudinally striate almost throughout, with a very narrow median band of weaker sculpture. Propodeum having submedian carinae gently divergent, curving gently outward and with no median carina or occasionally an incomplete one: nucha rather deeply emarginate behind: spiracles small, elongate-oval, the spiracular area, seen from above, produced into a sharp tooth above the hind coxa.

Petiolar segment a little broader at base than long, with rather fine reticulation comparatively strongly outstanding. Gaster beyond petiole ovate, pointed: first large tergite well over half its length, with reticulation present on less than apical half, comparatively strong, very distinct × 45, the following tergites very finely reticulate to trans-striate.

Hind tibial spur slightly curved, extending well beyond apex of corresponding metatarsus.

Head blue-black to very dark green, with slight bronzy reflection. Antennae dark blue-green. Thorax mainly blackish, with weak brighter reflection, the propleura in part and mesopleura above dark blue-green, the pronotal collar, tegulae and propodeum bright blue-green. Gaster blackish, though not so dark as mesonotum, the first large tergite blue-green in less than basal half. Legs dark blue-green, the hind tibiae brighter above, the tarsi stramineous, with the apical segment strongly infuscate.

Described from the following. NIGERIA: Ibadan, 5 ♀♀ (including neotype) 12.v.1971, *ex* puparia *Melanagromyza vignalis* Spencer (Agromyzidae) (det. K. A. Spencer) on *Vigna unguiculata* (Leguminosae) (W. K. Whitney). 'FRENCH SUDAN', 2 ♀♀ (probably 1946), '*ex* seeds of *Vigna*' (*R. Dugast*). Two males are present in the latter series: they have the thorax mainly blue-green.

The above two series of specimens, which have been reared in association with *Vigna*, run in the key of Risbec (1951) to *vignae* (Risbec). I place them as that species although I cannot make sense of the differences given (p. 67) from *dipterae* (Risbec), which is studied below in the present work. Risbec presumably intended to include an extensive description of *vignae* in 1951: he made no mention of the species whatever in his 1958 paper.

Since the original material has not been traced in ORSTOM, a neotype is designated here. A female specimen from 'French Sudan' will be deposited in ORSTOM.

## ***Pediobius*** species, ***afronigripes*** group

These are related to the palaearctic species *pyrgo* (Walker). *P. pyrgo* differs from all four here treated in having the first large tergite distinctly, finely and rather densely punctate in greater part above, and in that the hind tibial spur extends very little beyond apex of the corresponding metatarsus. It has the head less narrowed behind eyes, less even than in *vigintiquinque* Kerrich. The frontovertex has reticulation very distinct × 45 as in *afronigripes* nom. n. though somewhat finer. The eyes are decidedly more strongly and densely hairy than in *amaurocoelus* (Waterston), very distinctly hairy × 25. The funicle is strongly broadened in side view, more so than in *dipterae* (Risbec), having the third segment about one and a half times as broad as long. The sculpture of the mesoscutum is of similar pattern but a little weaker and finer than in *afronigripes* though much stronger than in the other three species.

## ***Pediobius afronigripes*** nom. n.

*Pleurotropis nigripes* Waterston, 1915 : 345–6, 348, 353–5, 357. LECTOTYPE ♀, NIGERIA: Ibadan (BMNH), here designated [examined]. [Secondary homonym of *Semiotellus*(?) *nigripes* Lindemann, 1887 (= *Pediobius epigonus* (Walker, 1839).]

*Pleurotropis nigripes* Waterston; Masi, 1940 : 301–2.

*Pediobius nigripes* (Waterston) Kerrich, 1970 : 328–9.

Head, seen from above, about two and two-thirds times breadth of its median length. Frontovertex about or rather less than twice the dorsal breadth of an eye and one quarter broader than its median length, with ocelli in an almost equilateral triangle; rather dull, in greater part rather weakly reticulate but the reticulations very distinct × 45, in inter-ocellar area and behind the lateral ocelli with reticulation rather fine. Sides of upper face moderately reticulate. Eyes finely and sparsely hairy.

Antenna (Waterston, 1915, fig. 2g) having scape about five times length of its greatest breadth: funicle not evidently broadened in side view, the first segment about one and a half times length of its greatest breadth, the third very distinctly longer than broad, the segments distinctly petiolate at apex.

Pronotal collar having sides slightly to moderately narrowed. Notauli sharply impressed and moderately strong in anterior two-fifths, almost effaced behind this: notaular pits ill-defined but bearing a deeper diagonal furrow, and the main seta about one-third the way forward, this seta relatively strong, extending back to about mid point of scutellum: mid lobe of mesoscutum with reticulation rather wide-meshed and of moderate strength in middle, merging to striate-reticulate in front, behind and towards the notauli, the parapsides more finely striate-reticulate in greater part, moderately reticulate at sides: hind margin moderately sinuate. Scutellum rather strongly longitudinally striate-reticulate, having a median band that is narrow and with evanescent sculpture in front, rather broader and almost smooth behind. Propodeum (Waterston, 1915, fig. 5) having submedian carinae curving gently outward and with a median carina or strong indication of such: nucha rather strongly convex, moderately emarginate at apex: spiracles short-oval, the spiracular area, seen from above, produced into a sharp tooth above the hind coxa.

Petiolar segment much broader at base than long, with anterior margin strongly raised, rather finely reticulate, with longitudinal ridges absent or weak and very incomplete. First large tergite about half length of gaster beyond petiole, very delicately reticulate on the bronzy part, the following tergites extremely finely reticulate to trans-striate.

Hind tibial spur curved, extending far beyond apex of corresponding metatarsus.

Head blue-green, with weak brassy and bronzy reflections. Antennae blue-green. Thorax blue-green, the pronotal collar and also the propodeum above tending to be rather brighter. Gaster dark bronzy, the first large tergite blue-green in about basal two-thirds. Legs dark blue-green, the tarsi stramineous, with the apical segment fuscous.

Of the syntypes there now stand in the collection of the British Museum (Natural History) 7 ♀♀, 2 ♂♂, mounted on four cards altogether. I select as lectotype the right-hand specimen of three females mounted on one card: the other two specimens on this card lack the head. I find no slide-mounted material in the collection, nor is there any cocoon of a primary parasite mounted on any of the cards or separately.

Redescribed from the female syntypes, NIGERIA, and the following. ETHIOPIA: former Eritrea, Ala Plain, Decamere, 1 ♀, 9.ix.1963, *ex Spodoptera* (= *Laphygma*) *exempta* (Walker) (*E. S. Brown*). UGANDA: Kampala, 12 ♀♀, v.1925, *ex Apanteles* cocoons (*G. L. R. Hancock*). NIGERIA: 2 ♀♀, 30.iv.1969, *ex* cocoons on leaf, *per* Ministry of Agriculture, Harpenden.

### ***Pediobius vigintiquinque*** Kerrich

(Pl. 3, fig. 6)

[*Pleurotropis nigripes* Waterston; Waterston, 1925 : 395. Misidentification.]
*Pediobius vigintiquinque* Kerrich, 1970 : 328–9. Holotype ♀, GHANA: Pretsea (BMNH) [examined].
*Pediobius* sp. 'hyperparasite', Mariau & Morin, 1971 : 86.

Head, seen from above, little more than twice breadth of its median length, less sharply narrowed behind eyes than in *afronigripes* nom. n. and *amaurocoelus* (Waterston) (Kerrich, 1970 : 328–9). Frontovertex about twice the dorsal breadth of an eye and less than a quarter broader than its median length, with ocelli in an almost equilateral triangle; in greater part shining and almost smooth, though on inter-ocellar area with reticulation just comfortably distinct × 65 or sometimes weaker. Sides of upper face moderately reticulate. Eyes extremely finely and sparsely hairy.

Antenna having scape about five times length of its greatest breadth: funicle evidently broadened in side view, the first segment about one and a half times length of its greatest breadth, the third about quadrate, the segments very distinctly petiolate at apex.

Pronotal collar having sides slightly or, more often, moderately narrowed. Notauli sharply impressed, very fine, running into the notaular pits which are ill-defined and bear the main seta about one-third the way forward: sculpture of mesoscutum much as described for *afronigripes* nom. n. but much weaker, the parapsides usually almost wholly reticulate: hind margin moderately sinuate. Scutellum finely longitudinally striate-reticulate at sides, with a median band that normally is relatively broad, about as broad as the distance between the setae in the notaular pits, and is smooth or almost so, but is narrower in darker coloured specimens. Propodeum having submedian carinae diverging gently and almost regularly from base, and with a median carina that usually is very distinct but does not reach base: nucha rather strongly convex, rather deeply emarginate at apex: spiracles elongate-oval, little more than their longer diameter from margin of metanotum, the spiracular area, seen from above, produced into a very sharp tooth above the hind coxa.

Petiolar segment little broader at base than long, with anterior margin only moderately raised, rather finely reticulate, with longitudinal ridges extremely weak and incomplete. Gaster beyond petiole about as described for *afronigripes* nom. n., but sometimes relatively elongate.

Hind tibial spur curved, extending far beyond apex of corresponding metatarsus.

Frontovertex dark blue-green to dull blue, occasionally with red-violet: upper and lower face and cheeks a brighter green, with bronzy reflections. Antennae blue-green, the metallic colour sometimes pale. Thorax blue-green, or in part blue or red-violet, with infusions of bronzy especially along fore margin of mesoscutum, around notauli and at sides of scutellum: sometimes the thorax is largely blackish: propodeum blue-green, or sometimes in large part red-violet. Gaster dull brown, the first large tergite in about basal half blue-green, merging to blue and red-violet, or more extensively red-violet. Legs green, or sometimes in part blue to red-violet, the tarsi stramineous, with the apical segment fuscous.

GHANA, IVORY COAST. Described from holotype and female paratypes. Many males also present in the series. This species is a hyperparasite.

BIOLOGY. This species has been reared as a secondary parasite of *Coelaenomenodera elaidis* Maulik (Hispidae) through *Pediobius setigerus* Kerrich, *Sympiesis kampalanus* (Ferrière) and *Cotterellia podagrica* Waterston (see Kerrich, 1970; Mariau & Morin, 1971).

### ***Pediobius amaurocoelus*** (Waterston)

*Pleurotropis amaurocoela* Waterston, 1915 : 345–6, 348, 355–7. LECTOTYPE ♀, MALAWI: Dedza (BMNH), here designated [examined].
*Pleurotropis amaurocoela* Waterston; Masi, 1940 : 301–2.
*Pediobius amaurocoelus* (Waterston) Kerrich, 1970 : 328–9.

Head, seen from above, about or nearly three times breadth of its median length. Frontovertex about twice the dorsal breadth of an eye and one-third broader than its median length, with ocelli in an almost equilateral triangle; in greater part shining, with reticulation not or hardly distinct × 65, though in inter-ocellar area very fine, the meshes just comfortably distinct × 45. Sides of upper face rather finely reticulate. Eyes rather sparsely but moderately strongly hairy, the hairs very distinct × 45.

Antenna (Waterston, 1915, fig. 2i) having scape about six times length of its greatest breadth: funicle evidently broadened in side view, the first segment nearly one and a half times length of its greatest breadth, the third a little broader than long, the segments petiolate at apex.

Pronotal collar having sides slightly to moderately narrowed. Notauli sharply impressed, fine, not effaced medially but running into the notaular pits which are as described for *afronigripes* nom. n.: sculpture of mesoscutum much as described for *afronigripes* though much weaker: hind margin moderately sinuate. Scutellum as described for *afronigripes*, but the sculpture weaker. Propodeum (Waterston 1915, fig. 8) having submedian carinae curving gently outward, rather closer together at base than in *afronigripes*, and with a very fine median carina: nucha short and rather strongly convex (this is not clearly represented in Terzi's drawing), weakly emarginate at apex: spiracles very small, short-oval, much more than their longer diameter from margin of metanotum, the spiracular area, seen from above, produced into a very sharp tooth above the hind coxa.

Petiolar segment as described for *afronigripes*, but very finely reticulate. Gaster beyond petiole as described for *afronigripes*.

Hind tibial spur curved, extending far beyond apex of corresponding metatarsus.

Head blue-green to dark blue, with shining brassy to bronzy reflections. Antennae blue-green with brassy reflection. Thorax blue-black, or sometimes mainly blue-green above, the pronotal collar and propodeum above brighter. Gaster dull brown, the first large tergite with some blue or blue-green reflection, usually only in basal half but sometimes more extensive. Legs green to, more usually, blue, the tarsi pale stramineous, with the apical segment fuscous.

Syntype material. MALAWI, NIGERIA and EGYPT. All ten female specimens now stand in the collection of the British Museum (Natural History), except one of the Nigerian series. Waterston stated, however, that the type was a ♀ from Dedza, Malawi and I select the better of these two specimens as lectotype. One antenna of the paralectotype was mounted on a slide. The other specimens are paratypes.

Redescribed from the female syntypes and the following. KENYA: Nakuru, ♀, 11.vi.1965, *ex Ecphoropsis* sp. (Ichneumonidae) on *Spodoptera* (= *Laphygma*) *exempta* (Walker) (*E. S. Brown*). TANZANIA: Karatu, 6 ♀♀, 5.v.1965, *ex S. exempta* (Walker) (*E. S. Brown*).

Also attributed to this species. ZAIRE: Bambesa, 6 ♀♀, xii.1936–i.1937, *ex Sylepta derogata* Fabricius on cotton (*J. Vrydagh*) (det. Ch. Ferrière).

And further: GHANA: Kumasi, 1 ♀, 1 ♂, em. 27.vi.1971, *ex* pupa of *Epilachna similis* Thunberg, on maize (*G. Scheibelreiter*). Dr Scheibelreiter confirms the accuracy of this record, stating that the pupa was isolated in a glass tube, so presumably these two small specimens were acting as hyperparasites.

I do not notice any essential difference from *afronigripes* nom. n. in the pattern of the sculpture of the scutellum, such as appears to have been deduced by Masi (1940: 302) from Terzi's drawing in Waterston's paper. Waterston's observation on the 'preapical hollows', at the anterior end of the nucha, appears to be sound but seems poor as a diagnostic character.

## ***Pediobius dipterae*** (Risbec) **comb. n.**

*Pleurotropis dipterae* Risbec, 1951 : 51, 66–7. Syntypes of both sexes, SENEGAL: Bambey (ORSTOM, Paris) [examined].

Head, seen from above, rather broad, nearly three times breadth of its median length. Frontovertex comparatively narrow, about one and a half times the dorsal breadth of an eye and one-fifth broader than its median length, with ocelli in a strongly acute triangle; less shining than in *amaurocoelus* (Waterston), in greater part not quite smooth through having sculpture present though very indistinct, but on inter-ocellar area with reticulation distinct × 65. Eyes rather finely but moderately densely hairy, more densely so than in *amaurocoelus* (Waterston).

Antenna having flagellum rather strongly broadened in side view, the first funicle segment somewhat longer than broad, the third much broader than long, and basal club a little broader than third funicle segment.

Pronotal collar having sides scarcely rounded, slightly narrowed. Notauli extremely fine: notaular pits ill-defined but of moderate depth, bearing the main seta not far forward, this seta not uncommonly strong and not nearly reaching mid point of scutellum: mesoscutum very finely reticulate on mid lobe, merging to finely striate-reticulate behind and beside this, the parapsides moderately reticulate in hinder corner: hind margin scarcely sinuate. Scutellum striate-reticulate at sides, having a median band that is rather narrow, not quite smooth but with sculpture very indistinct. Propodeum having submedian carinae rather close together at base, diverging gently and almost rectilinearly to near apex, where they curve inward: nucha strongly convex, weakly emarginate at apex: spiracles small, short-oval, much more than their longer diameter from margin of metanotum.

Petiolar segment much broader at base than long, with anterior margin weakly raised, very finely reticulate and with longitudinal ridges incomplete. Remainder of gaster rather elongate and pointed, the first large tergite about two-fifths its length.

Hind tibial spur strongly curved, extending far beyond apex of corresponding metatarsus.

Frontovertex blue-green, merging to bronzy above the frontal fork: upper face, lower face and genae a darker blue-green with much infusion of bronzy. Antennae somewhat darker blue-green than frontovertex. Thorax and sides of propodeum brownish black with weak bronzy reflection: pronotal collar blue-green and brighter bronzy: tegulae blue-green: propodeum above bright blue-green. Gaster blackish brown with weak bronzy reflection, the first large tergite bright blue-green above in about basal two-thirds. Legs blue-green, the tarsi stramineous to pale testaceous, with the apical segment somewhat infuscate.

Redescribed from the following. SENEGAL: Bambey, 6 ♀♀, 21.x.1946 (*J. Risbec*). I assume these to be syntypes, reared from pupae of Diptera in a stem of millet, although there are six males, and not only one as recorded by Risbec, as well as the six females mounted on the same glass slide. The redescription has been made in conformity with my other descriptions so far as was practicable, but some features could not be seen so clearly as on card-pointed specimens, which may be viewed from all angles. The measurements must be regarded as less accurate. Apart from the antennal flagellum, the redescription has been made mostly from the female specimen that is nearly dorsoventrally situated on the slide. The heads of all female specimens had become detached from the bodies.

The single male specimen recorded by Risbec as reared from a Cosmopterygid pupa from Niébé is mounted on another slide. The specimen is very severely crushed. It is extremely unlikely to belong to the same species. I have not seen the material recorded by Risbec (1958 : 75) as reared by R. Paulian from thrips in Madagascar, but it seems unlikely that Risbec was correct in attributing this to the same species.

## KEY TO THE FEMALES OF THE AFRICAN SPECIES STUDIED

1 Frontovertex having reticulation strong or moderately strong and more or less regular . . . . . . . . . . . . . . 2

– Frontovertex having reticulation rather weak to indistinct, or regular but fine . 7

2 Bristles on head and thorax mostly black, relatively short and stout: eyes strongly but very sparsely hairy: sculpture on frontovertex, mesoscutum and scutellum remarkably similar, reticulate, usually a little coarser on mesoscutum than on frontovertex and a little coarser on scutellum than on mesoscutum: submedian carinae of propodeum approximately parallel, not close (Pl. 1, fig. 1): antennal scape in greatest part pale testaceous: femora and tibiae pale testaceous, with only slight metallic darkening on the femora . . . ***ropalidiae*** (Risbec) (p. 119)

– Bristles on head and thorax paler, normal for the genus (see other plate figures): eye pilosity very different: sculpture on mesoscutum and on scutellum markedly dissimilar: submedian carinae of propodeum closer at base and more or less divergent: antennal scape, femora and tibiae in greatest part strongly metallic blue-green . . . . . . . . . . . . . . 3

3 Propodeum and pronotal collar covered with outstanding fine reticulation, not at all shining: mesoscutum and scutellum hardly shining, the sculpture close and strongly outstanding . . . . ***rhyssonotus*** (Waterston Ms.) sp. n. (p. 120)

– Propodeum and pronotal collar shining, with reticulation absent or restricted and very fine: mesoscutum and scutellum more or less shining, the sculpture (e.g. Pl. 2, figs, 3, 4) less close and often less outstanding . . . . . . . 4

4 Rather small species of length about 1½ mm: eyes strongly convergent below and extending far below level of toruli (Text-fig. 4): ocelli in about an equilateral triangle but frontovertex not narrow, the lateral ocelli distinctly more than their longer diameter from orbital margin: third funicle segment much broader than

long: petiolar segment over $1\frac{1}{2}$ times length of its greatest breadth: gaster beyond petiole oval, not pointed toward apex, more densely hairy than in alternate
***taylori*** sp. n. (p. 121)

– Mostly larger insects: eyes not or hardly convergent below and not extending far below level of toruli: if the ocelli are in about an equilateral triangle the lateral are less than their shorter diameter from orbital margin: third funicle segment about quadrate or longer than broad: gaster pointed toward apex . . . . 5

5 Frontovertex narrow, distinctly less than the dorsal breadth of an eye, having median ocellus little more than its own breadth from orbital margin: eyes very densely hairy: hind tibial spur abnormally strong, nearly reaching apex of second tarsal segment . . . . . . . . . ***angustifrons*** sp. n. (p. 122)

– Frontovertex distinctly more than the dorsal breadth of an eye, having median ocellus about one and a half times its own breadth or more from orbital margin: eyes much less densely hairy: hind tibial spur of normal strength for the genus, reaching only a moderate distance beyond apex of metatarsus or occasionally not reaching apex of that segment . . . . . . . . . . 6

6 Head of normal shape for the genus, the frontovertex no more than about a quarter broader than long, the ocelli in a right-angled to acute triangle: eyes densely hairy: petiolar segment transverse: gaster beyond petiole more elongate and pointed, the first large tergite less than half its length: fourth segment of mid and hind tarsi only slightly darkened: associated with Lepidoptera
***neavei*** (Waterston) (p. 123)

– Head short and broad, the frontovertex about one-half or more broader than long, the ocelli in a slightly to very distinctly obtuse triangle [in all African material seen, in a very distinctly obtuse triangle]: eyes moderately strongly and densely hairy (cf. p. 163): petiolar segment, in African material studied, about a quarter longer than broad: gaster beyond petiole less elongate and pointed, the first large tergite about half its length or more: fourth segment of mid and hind tarsi well darkened: parasite of Epilachninae
***foveolatus*** (Crawford) subsp. ***mediopunctatus*** (Waterston) (p. 124)

7 Scutellum bearing about ten strong setae on either side: mesoscutum with setae stout and rather numerous: pronotum with about sixteen strong setae arising behind elevated margin of pronotal collar (Pl. 1 fig. 2) ***setigerus*** Kerrich (p. 125)

– Scutellum bearing the normal pair of bristles: setae on mesoscutum not so numerous, on pronotum normally six, as seen from above, arising behind anterior margin of pronotal collar . . . . . . . . . . . . . . 8

8 Head, as seen from above (Text-fig. 1) rounded before and behind eyes, the occiput narrow and sloping backward: petiolar segment strongly produced forward at sides, embracing the nucha: remainder of gaster (Text-fig. 2) very elongate, the first large tergite bulbous, the first five strongly overlapping their opposite sides beneath: legs exceptionally slender, the hind femur over five times length of its greatest breadth, the hind tibial spur only about three-fifths length of corresponding metatarsus.

Males micropterous, with eyes relatively small, the gaster triangularly narrowed beyond the first large tergite, the hinder tergites beset with strong, almost erect setae . . . . . . . . . . . ***acraconae*** sp. n. (p. 126)

– Not as above: head shape more resembling Text-fig. 10 or sometimes Text-fig. 11: petiolar segment not or hardly embracing the nucha: gaster shaped otherwise, though the tergites may overlap their opposite sides beneath: legs not exceptionally slender.

Known males macropterous, having gaster not as in alternate . . . . 9

9 Head of female abnormally broad for the genus, two and three-quarters to three times breadth of its median length: scutellum rather strongly convex . . . 10

– Head of female in most species not abnormally broad for the genus: scutellum of normal convexity for the genus or flatter: not having the combination of characters of either species in the next couplet . . . . . . . . . . 11

10 Sides of upper face, as usual in the genus, reticulate: sculpture of mesoscutum and scutellum rather similar, consisting of reticulation that is relatively strongly outstanding, that is in large part coarse and tends to be longitudinal (Pl. 5, fig. 9): female gaster (Text-figs 5–6) not, as in most species, gradually more or less pointed but of masculine form, relatively broad and, apart from the ovipositor sheaths, very broadly rounded at apex, having the first large tergite relatively large and the epipleura almost or quite meeting mid-ventrally for a considerable length: wing trichiation normal: eyes with pilosity rather sparse but of moderate strength **aspidomorphae** (Girault) (p. 128)

– Head shining all over, without distinct sculpture even on sides of upper face: sculpture of mesoscutum and scutellum dissimilar, that on scutellum very much the coarser: female gaster pointed, often strongly so: wing trichiation much denser than is usual in the genus: eyes not distinctly hairy (× 100): antennal scape but not tibiae mainly pale . . . . . . . **marjoriae** sp. n. (p. 131)

11 Pronotum having lateral angles prominent, as in *saulius* (Walker) (Bouček, 1965, pp. 11, 35–36), the collar strongly contracted behind its sharp anterior margin: notaular pits bearing a deep longitudinal impression, having a very sharp, almost transverse, anterior margin and bearing the main seta near inner corner almost immediately behind this margin, the interspace moderately to very strongly longitudinally striate: scutellum strongly longitudinally striate almost to apex, not appreciably more weakly so in mid line (Pl. 2, fig. 3) **coffeicola** (Ferrière) (p. 132)

– Pronotum not having lateral angles thus prominent, the collar having sides on the whole no more than moderately narrowed: notaular pits not of this form, bearing the main seta about in or, more commonly, behind the middle . . . 12

12 Lower face and clypeus uncommonly broad and flat for the genus (Text-fig. 3): mandibles elongate, sickle-shaped, with the lower tooth much longer and stronger than the upper (Waterston, 1915, fig. 5e): notaular pits rather shallow but very conspicuous, margined anteriorly by sharp continuations of the notauli and on inner side by converging striae which leave a comparatively narrow separation before the scutellum (Pl. 2, fig. 4) . . . **clinognathus** (Waterston) (p. 133)

– Otherwise: lower face and especially clypeus not so broad and flat: mandibles of more normal form: notaular pits more widely separated . . . . . . 13

13 Frontovertex delimited from upper face by a sharp transverse carina: propodeum having submedian carinae markedly bowed inward to middle then outward again: basalis of fore wing bearing several hairs, usually arranged in two rows: mesoscutum with a more or less developed median longitudinal impression in about hinder half . . . . . . . **arcuatus** sp. n. (p. 135)

– Frontovertex not delimited from upper face by a sharp carina, the head in profile rounded or with a mere fold in that position: propodeum having submedian carinae only slightly, if at all, bowed inward from base, either sub-parallel for part way back or, more usually, markedly divergent from near base: basalis of fore wing bearing a single row of hairs, normally two, or else bare . . . . 14

14 Scutellum rather strongly elongate-reticulate at sides, having a median band of moderate breadth finely but very distinctly reticulate, the pattern markedly different . . . . . . . . . . . . . . . 15

– Scutellum with sculpture otherwise, either more uniform, sometimes narrowly weaker in mid line, or having a median band shining, smooth or with sculpture indistinct . . . . . . . . . . . . . . . 17

15 Frontovertex one-third broader than its median length, with ocelli in a very distinctly acute triangle: first funicle segment, in side view, about one and three-quarters times length of its greatest breadth: propodeum (Waterston, 1915, fig. 10) having

microsculpture obvious × 65 between the submedian carinae and on hinder part of submedian areas: length nearly 2 mm: reared from a stalk-boring larva **homoeus** (Waterston) (p. 136)

– Frontovertex over 1½ times breadth of its median length, with ocelli in a distinctly obtuse triangle: first funicle segment, in side view, not more than about one and a third times length of its greatest breadth: propodeum without such obvious microsculpture as described for alternate: length about 1½ mm or less: parasites in eggs . . . . . . . . . . . . . . 16

16 Mesoscutum finely and regularly reticulate throughout, with notaular pits shallow and ill-defined (Pl. 3, fig. 5): pronotum including collar and frontovertex having similar reticulation: propodeum normally convex for the genus: cubital hair-row starting beyond speculum postbasale: frontovertex blue-green and thorax a dull green: parasite in eggs of Lepidoptera . . . **anastati** (Crawford) (p. 137)

– Mesoscutum extensively longitudinally striate-reticulate, notably between the notaular pits which are of moderate depth: pronotal collar more shining, with reticulation very fine, sometimes indistinct: propodeum rather strongly convex: cubital hair-row sparse immediately beyond basalis, then much denser, very distinctly arcuate: frontovertex with at least the ridges blackish bronzy and thorax blackish brown: parasite in eggs of Hemiptera cf. **africanus** (Waterston) (p. 144)

17 Scutellum, except at sides, almost flat . . . . . . . . . 18

– Scutellum normally convex for the genus . . . . . . . . . 21

18 Scutellum almost regularly sculptured throughout, little if any less strongly so in mid line . . . . . . . . . . . . . . 19

– Scutellum with a median band smooth or almost so . . . . . . . 20

19 Scutellum rather coarsely longitudinally striate, with about 17 striae above: occipital margin sharp to not much below level of top of eye: clypeus with a pair of lateral teeth and a small median raised projection: pronotal collar almost straight-sided, almost smooth behind the distinctly raised margin: first large tergite less than half length of gaster beyond petiole: hind tibial spur reaching well beyond apex of corresponding metatarsus: femora and tibiae testaceous, with only slight metallic colouring on hind femora . . . . **praeveniens** sp. n. (p. 138)

– Scutellum much more finely and densely longitudinally reticulate to striate-reticulate; occipital margin sharp to below middle of eye: clypeus broadly almost truncate at apex: pronotal collar having sides sharply contracted, finely but very distinctly reticulate behind the weakly raised anterior margin, which does not delimit a sharp difference of sculpture: first large tergite about three-fifths length of gaster beyond petiole: hind tibial spur not or hardly reaching apex of corresponding metatarsus: legs except tarsi almost entirely dark blue-green **modestus** (Masi) (p. 139)

20 Frontovertex about 1½ times the dorsal breadth of an eye, with ocelli in an almost equilateral triangle, and having reticulate microsculpture before the ocelli quite distinct × 65: pronotum having neck elongate and collar very distinctly longitudinally striate-reticulate and having sides strongly expanded and then sharply contracted; petiolar segment above with longitudinal ridges very weak: first large tergite just over half length of gaster beyond petiole. Somali Republic, taken on cotton plant but biology unknown . . . **hirtellus** (Masi) (p. 141)

– Frontovertex over twice the dorsal breadth of an eye, with ocelli in a distinctly obtuse triangle, and having no sculpture distinct × 65 before the ocelli: pronotum having neck of normal length and collar without distinct sculpture and having sides rounded and slightly narrowed: petiolar segment above with rather strong longitudinal ridges: first large tergite about two-thirds length of gaster beyond petiole: parasite of lepidopterous stalk-borers. Sudan to Rhodesia and west to Sierra Leone . . . . . . . . . **furvum** (Gahan) (p. 142)

21 Very small species, of length little more than 1 mm.: legs before tarsi in greater part dull ochreous, with only light metallic colouring: antennal funicle having all segments quadrate or broader than long; nucha small, well rounded at apex: mostly dark, the green coloration obscure except on face and propodeum: parasitic in eggs . . . . . . . . ***telenomi*** (Crawford) (p. 143)

– Larger species: legs before tarsi wholly metallic: nucha more or less emarginate at apex . . . . . . . . . . . . . . . . . 22

22 Length about 1·2 mm and thorax blackish brown: median band of scutellum narrow, having the longitudinally striate sculpture always markedly weaker but not always evanescent: gaster beyond petiole relatively short, the fore wings extending far beyond its apex: frontovertex having, in the two African species following, reticulation in large part distinct × 65: first funicle segment little longer than broad . . . . . . . . . . . . . . . . . 23

– Larger species, mostly about 1·5 mm in length, often with thorax blue-green: median band of scutellum at least somewhat broader, shining throughout its whole length or with sculpture very indistinct: gaster elongate-ovate, the fore wings not extending far beyond its apex: frontovertex having reticulation, except on inter-ocellar area, indistinct except in *afronigripes* nom. n. in which the *third* funicle segment in side view is very distinctly longer than broad: not as diagnosed for *africanus* (Waterston) immediately below, the ocelli in a strongly acute triangle (*afronigripes* group) . . . . . . . . . . . 25

23 Head markedly broader than thorax, strongly transverse, with ocelli in a slightly to distinctly obtuse triangle: propodeum relatively strongly convex, the spiracular area produced into a rounded lobe above the hind coxa: eyes not evidently hairy × 100: parasitic in eggs . . . . . ***africanus*** (Waterston) (p. 144)

– Head not so transverse, with ocelli in a strongly acute triangle: propodeum no more than normally convex, the spiracular area produced into a prominent sharp tooth above the hind coxa: eyes evidently hairy × 65: not parasitic in eggs . . 24

24 Mesoscutum in middle of mid lobe weakly, finely and rather regularly reticulate: scutellum more convex: antennal scape less slender, about four times length of its greatest breadth: eyes distinctly hairy × 65.
S.E. Asia, introduced to Ivory Coast . . . . ***parvulus*** (Ferrière) (p. 182)

– Mesoscutum in middle of mid lobe much less weakly and more coarsely elongate-reticulate: scutellum less convex: antennal scape slender, about six times length of its greatest breadth: eyes distinctly hairy × 25 . . ***vignae*** (Risbec) (p. 146)

25 Frontovertex (Waterston, 1915, fig. 7b) rather dull, having reticulation quite distinct × 45 throughout: antennal funicle not evidently broadened in side view, the third segment usually very distinctly longer than broad (Waterston, 1915, fig. 2g): sculpture of mesoscutum stronger, of moderate strength in middle
***afronigripes*** nom. n. (p. 147)
( = *nigripes* Waterston, 1915, *non* Lindeman, 1887)

– Frontovertex, except on inter-ocellar area, more or less shining, having sculpture not or hardly distinct × 65: antennal funicle evidently broadened in side view, the third segment about quadrate or broader than long (e.g. Waterston, 1915, fig, 2i): sculpture of mesoscutum much weaker . . . . . . 26

26 Head less sharply narrowed behind eyes (Kerrich, 1970, fig. 2): eyes extremely finely and sparsely hairy: propodeum having nucha rather deeply emarginate at apex and spiracles larger, elongate-oval, little more than their longer diameter from margin of metanotum: petiolar segment little broader at base than long
***vigintiquinque*** Kerrich (p. 148)

– As in *afronigripes* nom. n. (Kerrich, 1970, fig. 1) head very sharply narrowed behind eyes: eyes less finely and sparsely hairy, the hairs very distinct × 45: propodeum having nucha weakly emarginate at apex and spiracles very small, short-oval, much more than their longer diameter from margin of metanotum: petiolar segment much broader at base than long . . . . . . . . . 27

27 Frontovertex about twice the dorsal breadth of an eye: third funicle segment in side view little broader than long: mesoscutum more shining, as in *afronigripes* nom. n. having the seta arising from the notaular pit uncommonly strong, nearly reaching mid point of scutellum, the hind margin moderately sinuate **amaurocoelus** (Waterston) (p. 149)

– Frontovertex about 1½ times the dorsal breadth of an eye: third funicle segment in side view much broader than long: mesoscutum duller, the seta arising from the notaular pit not uncommonly strong, not nearly reaching mid point of scutellum, the hind margin scarcely sinuate . . . **dipterae** (Risbec) (p. 150)

## AFRICAN SPECIES NOT STUDIED

A comprehensive revision of the Risbec species is outside the scope of this paper, although certain have been studied. A number were described from males only, several from a single male. In such a case as *P. braconiphaga* Risbec, 1951 the whole of the material cited should be studied for the selection of a lectotype. Under some names the material cited has such diverse host-relations that I do not expect all series to belong to the same species even in this very versatile genus. From the figure, I would expect *P. ambilobei* to be a species of *Schizocharis* Kerrich.

## SOUTHERN ASIATIC AND AUSTRALIAN SPECIES

### *Pediobius occipitalis* sp. n.

(Text-figs 9, 13)

Head, seen from above (Text-fig. 9), well rounded and not, as in most species, strongly narrowed behind eyes, about two and a third times breadth of its median length, with occipital costa completely absent. Frontovertex about 1·4 times breadth of its median length and three times the dorsal breadth of an eye, with ocelli in a very obtuse triangle, small, the lateral about twice their own diameter from orbital margin: setae small, rather upstanding, inconspicuous in this view. Reticulation on frontovertex moderate to very fine but very weakly raised, on sides of upper face fine to very fine and weakly raised, and on lower face and clypeus very fine but quite distinct. Eyes moderately densely and rather strongly hairy.

Antenna having scape four and a half times and pedicellus twice length of its greatest breadth; funicle markedly broadened in side view, the first segment nearly as broad as long, the third about one and a half times as broad as long, the segments shortly petiolate at apex, the club excluding terminal spine a little longer than first two funicle segments combined.

Pronotal collar covered with reticulation that is fine to very fine but quite distinct, its sides almost parallel or somewhat expanded, its fore margin indicated but not at all raised. Notauli not sharp, deeply impressed anteriorly, much more shallowly so medially, running to shallow notaular pits that are not defined nor distinctively sculptured and which bear the main seta well forward of the hind margin: mesoscutum sculptured much as pronotum, covered with reticulation that is weakly raised but very distinct, merging from fine on mid lobe to very fine on parapsides: hind margin very gently curved. Scutellum about as broad as long, very weakly convex, finely longitudinally striate and not appreciably more weakly so in mid line, merging to reticulate near hind margin. Propodeum having submedian carinae relatively far apart at base, diverging gently at first, then much more strongly but in an inwardly-directed curve, with median carina often rather strong, the whole upper surface very finely reticulate, the reticulation extremely weakly raised on anterior parts of lateral areas, which in consequence are rather shining, but much more definitely though not strongly so behind and on median area: nucha short, rather deeply emarginate: plicae laterales in almost hinder half produced into a strongly raised crest which overhangs the spiracular area: spiracles prominent, circular, almost as far from fore as from hind margin of propodeum.

Petiolar segment twice the basal breadth of its median length, with whole anterior margin sharply raised, with very fine but strongly outstanding reticulation and with irregular longitudinal ridges. Gaster beyond petiole very broad-oval, about a quarter longer than broad or less, the first large tergite slightly more than half its length, obscurely sculptured in greater part, the following tergites much more distinctly, finely and delicately reticulate.

Apical segment of all tarsi greatly swollen (Text-fig. 13), that of fore tarsi the most swollen. Hind tibial spur straight, reaching slightly beyond apex of corresponding metatarsus.

Head, thorax and sides of propodeum very dark green to blackish, with weak metallic reflection: propodeum above, though markedly brighter, a rather dark blue-green. Antennae dark blue-green. Gaster blackish brown, the first large tergite dark blue-green in less than basal half, the following tergites with extremely fine apical margins dark blue-green. Legs very dark green to blackish, the tibiae more prominently blue-green, often pale at extreme apex, the tarsi pale testaceous to stramineous, with the apical segment darkened.

Holotype ♀. HONG KONG: New Territories, Tai Lung, 13.iv.1964, *ex* pupa of Pine Shoot Borer, *Dioryctria splendidella* Herrich-Schäffer (Pyralidae, Phycitinae), *per* H. Y. Lee, Agriculture and Fisheries Department.

Paratypes. HONG KONG: 2 ♀♀, 4.vi.1962, 5 ♀♀, 13.iv.1964, same data as holotype. THAILAND: Baw Luang, 3 ♀♀, 10.xii.1968, *ex Rhyacionia cristata* Walsingham (Tortricidae), *per* CIBC.

One male is present in the series from Thailand. It agrees in most respects with the female, but the fore femora are very stout, and the setae near apex of gaster uncommonly strong.

This is so very differently characterized from most species of *Pediobius* that it seems likely at some stage to be placed in a separate genus.

### *Pediobius inexpectatus* sp. n.

Head, seen from above, about 2·4 times breadth of its median length. Frontovertex about one and a quarter times or less the breadth of its median length and about twice the breadth of an eye, with ocelli in a distinctly acute triangle; rather strongly reticulate throughout, somewhat more finely so before the lateral ocelli but not more weakly so beside and behind them. Inter-scrobal prominence and genae moderately reticulate: sides of upper face rather strongly so. Carinae from lateral ocelli to orbital margins well developed: occipital carina strong but comparatively short, not extending far below level of top of eyes. Eyes, seen from above, distinctly emarginate in hinder half of inner margin, in facial view extending below level of toruli, finely and rather sparsely hairy.

Antenna having scape narrow but obviously broadened in about apical half, over five times length of its greatest breadth: funicle slightly broadened in side view, the segments moniliform, very distinctly petiolate apically, the first excluding petiole almost oval, about one and a half times as long as broad, the second and third almost quadrate, and club, excluding terminal spine, over one and a half times the length of either.

Sides of pronotal collar slightly to moderately narrowed. Notauli having sharp anterior margin, which continues as a sharp inner margin of the notaular pits running to not far from hind margin of mesoscutum, the notaular pits rather shallow, not defined on outer side, and bearing the main seta rather near inner hind corner: mesoscutum strongly reticulate on mid lobe and greater part of parapsides, more finely so anteriorly and near outer margins: hind margin almost rectilinear between inner corners of axillae. Scutellum rather weakly convex, almost striate very near mid base but in greatest part strongly reticulate, much as on large part of mesoscutum but in part more elongately so, having a shining hind margin projecting backward over a large part of the metascutellum. Propodeum having submedian carinae close together at base, whence rather weakly though quite distinctly divergent for about two-thirds their length, then more strongly so, extremely finely reticulate and with no distinct median carina between them: nucha broadly and rather weakly emarginate at apex: spiracles small, elongate, the spiracular area, seen from directly above, not falling so steeply as in most species, produced into a strong crest above the hind coxa.

Petiolar segment having sides strongly expanded to base, there over one and a half times breadth of its median length, with anterior margin sharp, rather strongly raised in middle and to corners, very finely reticulate above, with two or more weak and incomplete longitudinal keels from mid base. Remainder of gaster broad-oval, about one-fifth longer than its greatest breadth, the first large tergite about half its length, comparatively strongly reticulate on dark part of first large tergite, increasingly finely so on following tergites.

Hind tibial spur slightly curved, extending slightly beyond apex of the relatively short metatarsus.

Head medium green, with overspread of brassy to bronzy, slight on frontovertex, often much stronger on upper and lower face, genae and clypeus. Antennae a more or less dull blue-green, with strong brassy to bronzy reflections. Thorax and propodeum medium green, often distinctly brighter than frontovertex, with light brassy and occasional bronzy reflections, the pleura with stronger reflections. Gaster dull bronzy, the first large tergite medium green in rather more than basal half, this and the following tergites with narrow, medium green apical margins. Legs medium to blue-green, with rather strong brassy to bronzy reflections.

Holotype ♀. New Guinea: Morobe District, Bubia, 18.ix.1968, *ex Melanitis constantia* (Cramer) (Lep., Satyridae, a pest of sugar cane), C. S. Li, *per* Dept. Agriculture, Stock & Fisheries (ANIC, Canberra).

Paratypes. New Guinea: 11 ♀♀ (same data as holotype); 11 ♂♂ present in the series. Paratypes and males in BMNH and ANIC, Canberra.

This has more the general facies of a European than of a far eastern tropical species. Among the species treated in this section of the present paper, it most resembles *illustris* (Waterston) and *acantha* (Walker), yet there are very distinct differences elaborated in the above description and subsequent key. It was necessary partly to dissect one of the female specimens to observe with accuracy the proportions of the petiolar segment. Since this is obviously transverse, and the male has inflexed epipleura, the species would run with *illustris* rather than *acantha* from couplet 27 in the key of Bouček (1965) (cf. comment in treatment of *acantha* below). The males of this species are cupreous, whereas those of *acantha* are blue-green.

### ***Pediobius illustris*** (Waterston)

*Pleurotropis illustris* Waterston, 1915 : 345, 357, 362–4. Holotype ♀, Iran: Ispahan (BMNH) [examined].

*Pediobius illustris* (Waterston) Bouček & Askew, 1968 : 94.

Head, seen from above, two and three-quarter times breadth of its median length, deeply emarginate behind. Frontovertex one and a half times breadth of its median length and more than twice the dorsal breadth of an eye, with ocelli in about a right-angled triangle; rather strongly and rather regularly reticulate almost throughout. Upper face moderately reticulate on sides and inter-scrobal prominence. Eyes, seen from above, distinctly emarginate in hinder half of inner margin, and in facial view relatively strongly emarginate, extending very distinctly below level of toruli, sparsely and rather finely hairy.

Antenna having scape elongate and narrow, about seven times length of its greatest breadth, about reaching median ocellus: funicle little broadened, having first segment about twice and third about one and a half times, length of their greatest breadth in side view, the segments very shortly petiolate at apex.

Sides of pronotal collar strongly rounded and slightly broadened. Notauli sharply impressed anteriorly and medially, running to notaular pits that are broad but shallow and ill-defined, and bear the main seta near inner side about two-fifths the way forward: mesoscutum strongly and almost regularly reticulate, though more finely so in the notaular pits, the hind margin moderately sinuate. Scutellum rather less strongly reticulate than the mesoscutum and becoming gradually more finely so toward the front (Waterston, 1915, fig. 13): axillae rather weakly and indefinitely and axillulae finely reticulate. Propodeum (unfortunately slightly damaged in the unique type) having submedian carinae subparallel about half way back then diverging at about 45° (Waterston, 1915, fig. 13) and with a distinct carina extending on to the nucha, which is broadly emarginate at apex: spiracles almost circular, the spiracular area produced into a small, blunt ridge above the hind coxa.

Petiolar segment strongly transverse, almost twice as broad as long, rather finely reticulate, angled at sides but with no longitudinal keel above, the anterior margin sharply but not strongly raised. First large tergite less than one-third length of gaster beyond petiole and almost smooth above: reticulate sculpture on all following tergites delicate but very distinct.

Hind tibial spur rather short and straight, reaching about mid length of metatarsus.

Large species: length over 2 mm.

Head blue-green to greenish blue above, broadly overspread with bronzy, dull blue-green below. Antennae having scape and pedicellus brownish black with moderate greenish blue reflection, and flagellum medium brown with very weak metallic reflection. Thorax and propodeum bright blue-green, with weak brassy reflections. Gaster dull bronzy, the first large tergite greenish blue on whole of upper surface, the four following tergites greenish blue along apical margins. Legs blue-green, the mid and hind tibiae pale at apex: mid and hind tarsi stramineous, the apical segment darkened, and the fore tarsi darkened.

Redescribed from the unique holotype, IRAN.

## ***Pediobius acantha*** (Walker)

*Entedon acantha* Walker, 1839 : 107–8. Holotype ♀, ENGLAND: London (BMNH) [examined].
*Pediobius acantha* (Walker) Bouček, 1965 : 10–4, 67–9.

Asiatic material examined. IRAQ: Baghdad, 1 ♀, 5.iv.1964, *ex* leaf-miner on turnip (*A. Awasi*) (det. J. A. J. Clarke, 1964); 1 ♀, 9.v.1970, *ex* leaf-miner on *Erigeron* (*per* Divn. Ent.). PAKISTAN: Rawalpindi, 3 ♀♀, 15–17.v.1961, *ex* dipterous leaf-miner on *Arundo donax* (*per* CIBC); Murree, 6 ♀♀, 25.v.1969, *ex Phytomyza* sp. on *Pisum sativum* (*per* CIBC). INDIA: Mysore, Bangalore, 3 ♀♀, 20.xii.1963 '*ex* Jowar leaf-miner' (? *Marasmia trapezalis* Guenée, a leaf-roller on *Andropogon sorghum*, the Indian millet) (*per* CIBC). Males also reared in all the above series. Most of this material in BMNH.

This form is so similar to *illustris* (Waterston) that I had taken it to be the same species, regarding Waterston's type as an exceptionally well developed specimen.

My colleague Dr Bouček pointed out, however, that the different proportions of the petiolar segment would lead from different alternates in couplet 27 of his European key (1965, p. 13). There is also the difference in relative length of the first large tergite, but Bouček records much variation in this in the large European material he examined. I find the following other differences from *illustris*: ocelli often in obviously less than a right-angled triangle, antennal scape relatively shorter and broader, not nearly reaching the median ocellus, sides of pronotal collar slightly narrowed, propodeum without a median carina. The first large tergite is one-third or more, often two-fifths, length of gaster beyond petiole, but not as much as half in any of the above-mentioned material.

## *Pediobius longisetosus* sp. n.

Head, seen from above, two and two-thirds times breadth of its median length. Frontovertex one and a half times breadth of its median length and over twice the dorsal breadth of an eye, with ocelli in a right-angled triangle, the lateral much more than their longer diameter from orbital margin; with sculpture very distinct throughout, but rather weak and very irrregular. Reticulation on sides of upper face weak but rather wide-meshed, on lower face and clypeus weak and fine but distinct. Eyes strongly but rather sparsely hairy.

Antenna having scape about five times length of its greatest breadth: funicle only slightly broadened in side view, the first segment about one and a half times as long as broad, the third distinctly longer than broad, the segments shortly but distinctly petiolate at apex.

Pronotal collar short, rather finely longitudinally striate above, moderately narrowed at sides. Notauli deeply but not sharply impressed, leading to notaular pits that are rather deep but not well defined, and which bear the main seta anteriorly: mid lobe of mesoscutum coarsely longitudinally striate except for a pair of anterior triangular areas situated just inward of the notauli, which bear outstanding fine reticulation: parapsides having striation somewhat less coarse, running diagonally toward and into the notaular pits: hind margin strongly sinuate. Axillae with outstanding reticulation. Scutellum coarsely longitudinally striate almost throughout, with moderate outstanding reticulation near hind margin. Propodeum having submedian carinae rather widely separated at base, moderately divergent then curving round and inward round the nucha, which is moderately emarginate at apex, having fine striation and reticulation between them, strongly shining beside them: spiracles small, circular, the spiracular area, seen from above, produced into a small tooth above the hind coxa.

Petiolar segment much broader than long, with anterior margin strongly raised in middle, very finely elongate-reticulate. Gaster beyond petiole comparatively strongly hairy, the first large tergite three-fifths its length, sparsely and irregularly punctate especially on the bronzy part, the remaining tergites extremely delicately sculptured.

Wing fringe exceptionally long for the genus, the cilia at anal angle about a quarter, the seta at junction of marginal and radial veins a third, the greatest breadth of fore wing. Hind tibial spur strong, reaching well beyond apex of corresponding metatarsus, the apical segment of all tarsi strong.

Setae exceptionally long and strong for the genus, the longest head seta, which arises just before the occipital margin, nearly the length of an eye, seen from above, the scutellar seta well over half the greatest breadth of fore wing.

Frontovertex steely green, blackish brown on inter-ocellar area: head in facial aspect steely green, largely overspread with blackish brown to bronzy. Antennae largely dark blue-green. Thorax and propodeum dark blue-green, with extensive overspread of bronzy. Gaster dull bronzy, the first large tergite blue-green in more than basal half. Legs blue-green, the tarsi stramineous, with the apical segment infuscate.

Unique holotype ♀. NEW HEBRIDES: unlocalized, 1935, '*ex* larva of Lymantriid on cocoa-tree' (*M. Risbec*) (BMNH).

### ***Pediobius ptychomyiae*** (Ferrière) **comb. n.**

*Pleurotropis ptychomyiae* Ferrière, 1940 : 137–8. Holotype ♀, JAVA: Res. Madioen, Patjitan (BMNH) [examined].

Head, seen from above, about two and a half times breadth of its median length. Frontovertex about a quarter broader than its median length and twice the dorsal breadth of an eye, with ocelli in about a right-angled triangle; moderately strongly reticulate, the meshes more transverse beside the median ocellus and smaller in inter-ocellar area, not much less strong beside and behind the lateral ocelli. Sides of upper face moderately reticulate. Eyes rather finely and densely hairy.

Antenna (Ferrière, 1940, fig. 5) having scape about four to five times length of its greatest breadth: funicle markedly broadened, having first segment about one and a half times length of its greatest breadth in side view and third about quadrate, the segments very distinctly petiolate at apex.

Sides of pronotal collar emarginate, very little narrowed. Notauli not deeply impressed anteriorly, running to rather triangular shaped notaular pits, which are not bordered on inner or outer side, and which bear the main seta less than one-third the way forward: mid lobe of mesoscutum and parapsides strongly reticulate, the reticulation merging to striation between and in the notaular pits, the reticulation on parapsides not differing markedly from that on mid lobe: hind margin weakly sinuate. Scutellum rather strongly and regularly longitudinally striate almost throughout, tending to be weakly reticulate narrowly in mid line. Propodeum having submedian carinae approximately parallel for more than half way back, then diverging at about 45° or usually distinctly less, and with no distinct median carina: nucha small, broadly emarginate at apex: spiracles short-oval, the spiracular area having one or two transverse rugae, as seen from above produced into a prominent sharp tooth above the hind coxa.

Petiolar segment much broader than long, very finely reticulate, with some longitudinal ridges. Gaster beyond petiole moderately elongate and markedly pointed towards apex, the first large tergite a little less than half length of gaster beyond petiole, the gaster delicately reticulate on dark part of first large tergite and increasingly finely reticulate on those following.

Hind tibial spur slightly curved, reaching a little beyond apex of metatarsus.

Head dark blue-green to blue, sometimes with bronzy or red-violet reflection. Antennae having scape stramineous, and pedicellus and flagellum pale brown, with dark green coloration more or less developed. Thorax and sides of propodeum dark brown, with weak brassy green sheen, or else dark blue-green, with bronzy reflection, the ridges of the reticulations and striae brown. Propodeum above, and usually the shining pronotal collar, a brighter blue-green. Gaster bronzy black, the first large tergite, except for mid apical patch, blue-green to greenish blue. Coxae and femora brownish black to brown, often with blue-green reflection or the hind femora wholly blue-green: tibiae pale testaceous to stramineous, the hind tibia with a little darkening near base, and tarsi stramineous, dark at extreme apex.

Material studied. JAVA, SUMATRA and WEST MALAYSIA, holotype and numerous female paratypes: male paratypes are also available. Not since received by CIE.

BIOLOGY (see van der Vecht 1950). Reared as a secondary parasite of *Artona catoxantha* Hampson through two species of Tachinidae and very occasionally through a species of *Apanteles*.

## *Pediobius bethylicidus* sp. n.

Head, seen from above, rather more than twice breadth of its median length. Frontovertex about one and a quarter times breadth of its median length and two and a half times breadth of an eye, with ocelli in a slightly acute triangle; with reticulation moderately strong and almost regular, beside and behind the lateral ocelli much more finely so but still decidedly outstanding. Sides of upper face rather finely reticulate, merging to finely so on cheeks: lower face and clypeus very finely but quite distinctly reticulate. Eyes rather weakly but rather densely hairy.

Antenna having scape about four times length of its greatest breadth: funicle strongly broadened in side view, the first segment a little longer than broad, the second a little and third much broader than long, and basal club segment much broader than third funicle segment.

Pronotal collar very finely, indistinctly reticulate, not smooth and shining, its sides strongly narrowed and strongly rounded. Notauli very fine, sharply impressed, often unusually transverse, leading to notaular pits that are rather well-defined and rather deep, are separated by an interspace about half the width of either, and bear the main seta much nearer inner margin and about a third the way forward: mid lobe of mesoscutum and parapsides with reticulation about as on frontovertex, merging to some rather indistinct striation between the notaular pits which are extremely finely reticulate, dull: hind margin rather weakly sinuate. Axillae finely reticulate. Scutellum rather strongly and regularly striate almost throughout, though more weakly and densely so near mid line, merging to reticulate near hind margin. Propodeum having submedian carinae sub-parallel or, rather, bowed very slightly inward for more than half way back, then diverging at nearly 45°, and with median carina absent or merely indicated: nucha very short, broadly and slightly to moderately emarginate at apex: spiracles almost circular, the spiracular area, seen from above, produced into a very sharp tooth above the hind coxa.

Petiolar segment much broader than long, finely reticulate, with longitudinal ridges more or less distinct. Remainder of gaster very broad-oval, almost flat above, the first large tergite almost two-thirds its length, delicately reticulate on the dark part, the following tergites increasingly finely so.

Hind tibial spur almost straight, reaching just beyond apex of metatarsus.

Frontovertex blue-green, usually with pale brassy to bright bronzy reflections though occasionally darker: face, clypeus and genae a darker blue-green, with duller, often bronzy, overspread. Antennae with scape pale testaceous, and with pedicellus and flagellum pale brown below, darker and with weak metallic reflections above. Thorax and propodeum dark blue-green, usually with pale brassy to bronzy reflections, though these often markedly less evident than on frontovertex. Gaster brown, weakly shining, the first large tergite blue-green in, usually, less than basal half. Legs very dark blue-green, the femora often pale at apex, the tibiae and tarsi pale testaceous, the apical tarsal segment slightly darkened.

Holotype ♀. INDIA: Uttar Pradesh, Lucknow, i.1963, 'secondary parasites of pupae of *Parasierola* sp.' (Bethylidae) 'on army worm' (? *Sesamia inferens* Walker, Phalaenidae), *per* P. N. Avasthy, Indian Institute of Sugarcane Research (BMNH).

Paratypes. INDIA: 15 ♀♀, same data as holotype; Lucknow, 3 ♀♀, 2.xii.1965, 'secondary parasite of army worm', *per* A. K. Kalra, Indian Institute of Sugarcane Research; Gola, 2 ex., ii.1971, '*ex* larva on sugar', *per* CIBC; W. Bengal, Plassey, 2 ♀♀, 27.xi.1969, *ex* cocoon *Goniozus* sp. (Bethylidae) associated with sugar, *per* CIBC.

### ***Pediobius foveolatus*** (Crawford) **comb. n.**

(Pl. 4, fig. 7)

*Pleurotropis foveolatus* Crawford, 1912 : 7. Holotype ♀, INDIA: Mysore, Bangalore (USNM, Washington).

*Pleurotropis mediopunctata* Waterston, 1915 : 345, 348, 353, 357–60. LECTOTYPE ♀, NIGERIA: Ibadan (BMNH), here designated (p. 124) [examined]. Here regarded as subspecies.

*Pleurotropis epilachnae* Rohwer, 1921 : 126–7. Holotype ♀, INDIA: Madras, Coimbatore (USNM, Washington). **Syn. n.**

*Pleurotropis foveolatus* Crawford; Ferrière, 1933 : 96.

*Pleurotropis epilachnae* Rohwer; Ferrière, 1933 : 96.

*Pleurotropis mediopunctata* Waterston; Masi, 1940 : 301–2.

*Pediobius epilachnae* (Rohwer) Burks, 1966 : 35.

*Pediobius epilachnae* (Rohwer); Baltazar, 1966 : 116.

Head, seen from above, rather variable in proportion but always relatively broad, two and a half to three times breadth of its median length. Frontovertex usually about one and a half times breadth of its median length and more than twice the dorsal breadth of an eye, with ocelli in a slightly to very distinctly obtuse triangle; rather strongly reticulate, though more finely so beside and behind the lateral ocelli. Sides of upper face moderately to rather strongly reticulate. Eyes moderately strongly and densely hairy.

Antenna having scape hardly broadened, about six times length of its greatest breadth: funicle having first segment about two and a half times length of its greatest breadth and third about quadrate, the segments distinctly petiolate at apex: the proportions of the funicle segments are often less dissimilar in smaller specimens.

Sides of pronotal collar strongly narrowed. Notauli sharply impressed and with sharp anterior margin, which continues as an anterior margin of the broad-oval notaular pits; these bear deep bronze-coloured longitudinal impressions, are usually bordered by moderate striae on inner and are not sharply bordered on outer side, and bear the main seta about one-third the way forward, the space between them being very much narrower than a pit: mid lobe of mesoscutum with reticulation of moderate strength and rather regular to rather coarse, tending especially to be coarser in the darker specimens, rather irregularly striate between the notaular pits, the parapsides much more finely striate to reticulate: hind margin strongly sinuate. Scutellum rather strongly striate-reticulate in greater part, merging to more regular reticulation in about apical third, narrowly in mid line in anterior half much more finely reticulate. Propodeum having submedian carinae diverging weakly from base and then more strongly but at much less than 45°, and often with a very weak median carina between them: nucha rather strongly convex, almost truncate or rather weakly emarginate at apex: spiracles elongate-oval, the spiracular area produced into a sharp tooth above the hind coxa.

Petiolar segment about as long as broad in Asiatic material, about a quarter longer in African, with anterior margin strongly raised, finely to very finely reticulate, sometimes with traces of longitudinal ridges but these not nearly percurrent. First large tergite about half length of gaster beyond petiole or more, dark part of first large tergite with reticulate sculpture varying from delicate but very distinct to evanescent, and following tergites with extremely delicate reticulate to trans-striate sculpture but prominent smooth margins.

Hind tibial spur curved, reaching well beyond apex of metatarsus, except in South African material studied.

Coloration of form described as *epilachnae* (Rohwer) – head mainly blue-green to greenish blue above, overspread with bronzy on triangle above frontal fork and on upper face, blue-green to blue-black below, the clypeus blue-green. Antennae blue-green, the scape and pedicellus rather darker. Thorax and sides of propodeum dull blue-green, with brassy and bronzy reflections, the propodeum above a rather brighter blue-green. Gaster dull bronzy to blackish brown, the first large tergite blue-green above in about basal two-thirds, the hinder tergites often with extremely fine, sea-green hind margins. Legs dull blue-green, the tarsi stramineous, darkened towards apex, but sometimes the legs are in part a brighter green, with the tibiae paler towards apex.

Form described as *foveolatus* (Crawford) differs as follows: head a darker blue-green or blue, or more overspread with bronzy, the clypeus often not green. Thorax and sides of propodeum blackish brown with bronzy reflection, the propodeum above, pronotal collar and propleura blue-green, or the thorax and propodeum mainly blue, with bronzy reflection.

In one Queensland series, one specimen has the frontovertex and thorax markedly brassy: in the other the males, instead of being coloured much like the females as in most series of the aggregate species studied, are strongly copper-coloured. Middle African material is mainly dark blue-green, with bronzy reflection notably before the occiput, and the hinder tergites usually have comparatively broad, sea-green hind margins.

South African material appears to differ in structure as well as colour. In the series from Natal the blue-green is replaced by red-violet, with some turquoise coloration: in that from Cape Province the thorax is greyish black. In both, the hind tibial spur is straighter and does not reach the apex of the metatarsus: in the Cape Province series the hind margin of the mesoscutum is weakly sinuate and the sculpture of the thorax, though of pattern characteristic of the species, is relatively weakly outstanding.

This species is so variable as to be difficult to characterize. It is no wonder that Rohwer (1921), on the material available, presumed that he had a species distinct from *foveolatus* Crawford, considering the size and the striking colour difference of the thorax. On a visit to North America in 1956, I had with me specimens regarded as typical of the two forms and made comparisons with paratype material. Since then I have endeavoured to determine Asiatic specimens received as one form or the other but, with the accretion of more material, having increasing difficulty. The sculpture of the scutellum, given as a difference by Rohwer and repeated by Ferrière (1933), is found to be of essentially the same pattern in the two forms, though the reticulation on the mid lobe of the mesoscutum is weaker, less regular and wider meshed in series of smaller specimens. Generally, the head is uncommonly broad for a *Pediobius* species, but this feature is much less marked in some series.

Discussing the question by correspondence with Dr B. D. Burks, I found that his experience had so closely paralleled my own that I sought his permission to quote. He wrote 'I will make no objections to the synonymy of *foveolatus* and *epilachnae*. The only difference I have been able to find between them is color—the type series of the two certainly differ in color, but subsequent material is harder to divide up. This has been successfully introduced into North America, so I have to contend with it quite a lot. I have been using *foveolatus*, the older name.'

My colleague Dr B. R. Subba Rao, who has field experience of parasites of *Epilachna* in India, told me he did not believe that *foveolatus* and *epilachnae* were separate species.

Species of *Pediobius* have almost always been studied on a regional basis, and it does not appear that African and Asiatic parasites of Epilachnines have previously been compared. Fewer series are available from middle Africa and less variation has been noted. In Asiatic material, however, the female petiolar segment is about quadrate whereas in African material it is about a quarter longer than broad. It seems best at the present time to treat the middle African material as having subspecific rank. The South African series may represent a further subspecies or incipient species, but much more material needs to be studied before this can be established on a satisfactory basis.

No other Asiatic species has been seen which would be difficult to separate from *foveolatus*, but the variability of the species as found in Asia and Australia does render more difficult the separation from the African form of the closest related species *neavei* (Waterston). All African series seen do have the characteristic broad head, and the reticulation has a marked tendency to be transverse beside the median ocellus. In *foveolatus* the eyes are described as moderately strongly and densely hairy, in *neavei* as densely hairy; but although this difference has not been quantified, it is readily appreciable when the two species are directly compared. That the tibiae are sometimes pale at apex invalidates Waterston's sole key character.

Material studied. Asiatic and Australasian. IRAQ: Abu Ghaib, 2 ♀♀, 11.x.1955, *ex* larva *Henosepilachna chrysomelina* (Fabricius), Abid Isa (compared 1956 with cotypes of *epilachnae* Rohwer). PAKISTAN: Lyallpur, 7 ♀♀, 15.vi.1968, *ex* pupa *Epilachna* sp., *per* CIBC. NEPAL: Katmandu, 2 ♀♀, 8.viii.1966, *ex Epilachna* 28-*punctata* Fabricius, *per* Dept. Agric. INDIA: Madras, Coimbatore, 1 ♀, 2.viii.1968, *ex* larva *Epilachna* sp. on brinjal, *per* CIBC; Orissa, Bhubaneswar, 3 ♀♀, 28.vii.1955, *ex* larva *Epilachna* sp., S. G. Sen Gupta; W. Bengal, Kalimpong, *ex* pupa *Epilachna* sp. on *Memordica charantica*, *per* CIBC. CEYLON: Peradiniya, 2 ♀♀, 10.v.1924, *ex* pupa *Epilachna* 28-*punctata* Fabricius, on *Memordica charantica* (*J. C. Hutson*); Tinnavelle, 1 ♀, 17.vii.1961, *ex Epilachna* pupa, ? captor. THAILAND: 2 ♀♀ (ref. A940), Ariant Manjikul. WEST MALAYSIA: Selangor, Kuala Lumpur, 3 ♀♀, 15.iv.1931, *ex* 'Epilachna 12-punctata', 4 ♀♀, 14.ix.1936, *ex Epilachna indica* Mulsant, *per* Divn. Ent. Dept. Agric. CHINA: Yunnan, Kunming, ♀♀, '*ex* larva of 2061', C. L. Liu (compared 1956 with cotypes of *foveolatus* Crawford). NEW GUINEA: Papua, 2 ♀♀, 7.iii.1970, *ex* pupa *Henosepilachna guttatopustulata* Fabricius, *per* CIBC. AUSTRALIA: Queensland, Brisbane, Samford, 8 ♀♀, 23.v.1960, *ex* larva *Henosepilachna sparsa* (Herbst) subsp. 26-*punctata* (Boisduval) (*E. P. Warwick & G. O. Stride*); Brisbane, 2 ♀♀, i.1971, *ex* Coccinellid pupa, *per W. R. Smith*.

African. ETHIOPIA: Ada Scioa, Bitscioftu, 1 ♀, *ex* 'Coccinellid no. 59' (*G. Jannone*); former Eritrea, Asmara, 2500 m., ♀♀, 15.ix.1946, *ex* pupa *Epilachna similis* Thunberg subsp. *tellini* Weise (*G. de Lotto*). KENYA: Nanyuki, 4 ♀♀, v.1968, *ex Epilachna* sp. (*R. G. Allan*). NIGERIA: Ibadan, 4 ♀♀, vii.1913, *ex* pupa *Epilachna* s.l., sp. (det. R. D. Pope) (*W. A. Lamborn*) (syntypes of *mediopunctata* Waterston). GHANA: Lawra, 4 ♀♀, 12.x.1939, *ex Henosepilachna chrysomelina* Fabricius, ? captor. ZAIRE: Kivu, Lubero, 4 ♀♀, 1949, 'parasite de Coccinellidae' (*P. Lefèvre*). SOUTH AFRICA: Natal, 1 ♀, 1960, *ex* pupa *Epilachna similis* Thunberg, *per F. J. Simmonds*; Cape Province, Alexandria, 2 ♀♀, 10.x.1958, *ex Epilachna hirta* Thunberg (*J. S. Taylor*).

### ***Pediobius elasmi*** (Ashmead)
### (Pl. 4, fig. 8)

*Asecodes elasmi* Ashmead, 1904*b* : 138. LECTOTYPE ♂, PHILIPPINES: Manila (USNM, Washington), here designated [examined].
*Pleurotropis lividiscutum* Gahan, 1922 : 49. Holotype ♀, SUMATRA: Padang (USNM, Washington). **Syn. n.**
*Pleurotropis lividiscutum* Gahan; Ferrière, 1933 : 96.
*Pleurotropis elasmi* (Ashmead) Gahan, 1951 : 170.
*Pediobius elasmi* (Ashmead) Baltazar, 1966 : 116.

Head, seen from above, 2·2 to 2·4 times breadth of its median length. Frontovertex slightly to about one-third broader than its median length and 2·0 to 2·4 times the dorsal breadth of an eye, with ocelli in an acute triangle; rather strongly to strongly reticulate almost throughout, but with reticulation finer and less strongly raised just above frontal fork. Sides of upper face moderately reticulate: lower face and clypeus, as normally in the genus, almost smooth, with sculpture generally indistinct, though occasionally there is a patch of weak but distinct reticulation to either side of the clypeus. Eyes moderately strongly and densely hairy, in facial view relatively strongly emarginate.

Antenna having scape distinctly broadened to about two-thirds its length, about three times length of its greatest breadth: funicle markedly broadened, having first segment about one and a half times length of its greatest breadth and third distinctly transverse in side view, the segments very distinctly petiolate at apex: club having two segments, the second very much the smaller, and a terminal spine.

Sides of pronotal collar slightly to moderately narrowed, very little rounded. Notauli moderately but not at all sharply impressed, running to notaular pits of moderate breadth and depth that are hardly defined outwardly but are bordered by a strong stria on inner side, and bear the strong main seta about in middle: mid lobe of mesoscutum with moderate, transverse reticulation in front, merging to stronger reticulation in middle and longitudinal striation which diverges round the raised part before the hind margin, which is strongly emarginate: parapsides moderately reticulate at sides, this merging to striation which runs into the notaular pits. Scutellum strongly longitudinally striate at sides, merging to reticulate behind: the broad median band is usually shining and almost smooth in anterior half or more, with the sculpture evanescent, but occasionally it has reticulate sculpture weak but distinct throughout. Propodeum having submedian carinae not very close, diverging rather weakly to moderately from base, and usually with no distinct median carina: nucha dull, sharply emarginate at apex: spiracles oval, the spiracular area, seen from above, produced into a prominent, sharp tooth above the hind coxa.

Petiolar segment nearly twice as broad as long, very finely reticulate, with weak longitudinal ridges anteriorly. First large tergite less than half length of gaster beyond petiole, the sculpture on dark part of this and the following tergites extremely delicate.

Hind tibial spur curved, reaching well beyond apex of metatarsus.

Head dark blue-green, with greater or lesser amount of bronzy and brassy reflection, often red-violet before the median ocellus, the ridges of the reticulations dark, sometimes having the upper face dull bronzy. Antennae blue-green. Sides of thorax and propodeum blue-green to blue-black and bronzy. Upper surface of thorax and propodeum blue-green to greenish blue, on mesothorax usually merging to bronzy laterally, occasionally with red-violet reflection; but sometimes the mesoscutum and scutellum are blackish brown. Gaster dull bronzy, the first large tergite dark blue-green to greenish blue, often with red-violet reflection, on about basal half above. Legs dark blue-green, the tibiae often a brighter green: tarsi pale stramineous, darkened towards apex. One specimen from Malaya has the frontovertex, thorax above and base of gaster mainly red-violet.

Redescribed from the following. INDIA: Mysore, Mandya, 10 ♀♀, 17.vii.1970, *ex* pupae of *Proceras indicus* Kapur (Pyralidae, Crambinae), *per* Deccan Sugar Co., 1 ♀, 28.viii.1964, *ex Sarcophaga* sp., *per* CIBC; Madhya Pradesh, Jagadalpur, 2 ♀♀, 5.iv.1962, *ex* Saturniid cocoon (*K. K. Verma*). CEYLON: Kowlwewa, 3 ♀♀, viii.1962, on *Manatha albipes* (*E. Dharmaraju*); Colombo, Museum garden, 2 ♀♀, 2.iii.1971, *per* W. T. T. Gunarwardene. THAILAND: Bangkok, Noi, 3 ♀♀, 25.x.1927, '*ex* cocoon of caterpillar on *Erythrina* sp.' (*W. R. S. Ladell*). WEST MALAYSIA: Batu Gajah, 2 ♀♀, 20.iii.1924, on larvae of *Artona catoxantha* Hampson (Zygaenidae) (*G. H. Corbett & B. A. R. Gater*); Menglerubu, 3 ♀♀, 14.iv.1934, on *A. catoxantha* Hampson, *per* Dept. Agric.; Selangor, Kuala Lumpur, 4 ♀♀, 22.vi.1932, *ex* pupa *Lamprosema camphorae* Tams (Pyraustidae), *per* Dept. Agric.; Kuala Lumpur, Carruthers Road, 5 ♀♀, 29.x.1954, *ex* Tachinid puparia from cocoons of *Attacus atlas* L. (Saturniidae) (*I. J. Wyatt*). SUMATRA: Pematang, Siantar, 4 ♀♀ (1 ♂), 9.ix.1931, 'bred from cocoons of parasite 126' and '*ex* puparium of Tachinid parasite 77' (*R. I. Nel*). JAVA: Bogor, 1 ♀, 8.iv.1919 'reared from Braconid cocoons' (*S. Leefmans*) (paratype no. 24657, USNM, Washington); Magelang, 2 ♀♀ (2 ♂♂), iv.1938, *ex Apanteles hilaridis* Rohwer (*Tjoa & R. Awibowo*). SABAH: Mostyn, 2 ♀♀, 20.viii.1969, *ex Apanteles* cocoon 'in' *Metisa plana* Walker (Psychidae), Beaufort, 1 ♀, 24.ix.1969, *ex* unidentified bagworm, Tuaran, 4 ♀♀, 22.xi.1969, *ex* bagworm on cocoa (*T. Sankaran*), CIBC. NEW GUINEA: Bubia, 4 ♀♀ (1 ♂), 10.x.1968 and 23.i.1969, *ex Borbo impar* Mabille (Hesperiidae), P.A.T.I., 2 ♀♀ ,29.vi.1971, '*ex* pupa no. 15796', *per* Dept. Agric.; Bulolo, 9 ♀♀ (2 ♂♂), *ex* lepidopterous larva on *Hibiscus* sp., *per* Dept. Forests.

I first identified this species as *lividiscutum* (Gahan) after studying the paratype received on loan. I later questioned Dr B. D. Burks as to *elasmi* (Ashmead). After studying my provisional key and redescription he wrote on June 5th, 1970, as follows: 'I had a go at your Oriental *Pediobius* key. I think that *elasmi* and *lividiscutum* are the same. All the types of *elasmi* are males, and have the middle of the scutellum quite smooth, but we have a long reared series of this species that has all the females with the middle of the scutellum sculptured, the males in the series varying from sculptured to smooth. The males mostly also lack the beautiful colors of the females'.

On May 4th, 1971, he wrote as follows: 'Ashmead designated no holotypes; when he happened to name a species from only one specimen, it may be considered to be the holotype. Otherwise, lectotypes must be designated. So the types of *Asecodes elasmi* Ashmead are syntypes. I have marked one labelled "Manila, P.I.; W. A. Stanton Collector; Asecodes elasmi Ashm. ♂; Type No. 7916 USNM" as lectotype. Please designate it in your paper.' This I hereby do.

### **Pediobius agaristae** (Cameron)

*Cluthaira agaristae* Cameron, 1912 : 211–2. LECTOTYPE ♀, AUSTRALIA: N.S.W., Sydney (BMNH), here designated [examined].
*Pediobius agaristae* (Cameron) Bouček, 1965 : 7–8.

Head, seen from above, 2·0 to 2·3 times breadth of its median length. Frontovertex about four-fifths breadth of to slightly broader than its median length and about one and a half times the dorsal breadth of an eye, with ocelli in a very distinctly acute triangle; strongly reticulate, though less so beside and behind the lateral ocelli, the reticulation mostly coarser in front of the median ocellus but very much finer and less strongly raised just above frontal fork. Sides of upper face rather strongly reticulate: lower face much more weakly, though very distinctly, reticulate except narrowly in mid line where, with the clypeus, it is almost smooth, the sculpture indistinct. Eyes strongly and densely hairy, in facial view relatively very strongly emarginate.

Antenna having scape hardly broadened to beyond middle, about five times length of its greatest breadth: funicle hardly broadened, 4-segmented, the first segment distinctly a little longer than broad, the following about quadrate or slightly transverse in side view and all very distinctly petiolate at apex: club composed of two regular segments, the second moderately smaller, plus a small terminal one (apiculus).

Sides of pronotal collar more or less strongly broadened to beyond middle, sharply narrowed behind: fore margin clearly indicated by a change of sculpture but not elevated. Notauli sharply impressed, running to rather narrowly triangular notaular pits that are sharply margined on inner side, are almost smooth and bear the main seta about in middle: mesoscutum having moderate, rounded reticulation in front merging to coarser, more transverse reticulation both between the notaular pits and on parapsides above, but having fine reticulation on sides of parapsides: hind margin between notaular pits scarcely emarginate. Scutellum strongly longitudinally striate at sides, merging to reticulate behind: the median band in about anterior half has the sculpture greatly weakening towards the front but is not shining and almost smooth. Propodeum having submedian carinae close, subparallel more than half way back then diverging at much less than 45°, and with no median carina: nucha rather strongly convex, distinctly sculptured: spiracles short-oval, the spiracular area, seen from above, produced into a blunt tooth above the hind coxa.

Petiolar segment a little longer than broad, finely reticulate, without longitudinal ridges above. First large tergite just over half length of gaster beyond petiole, almost smooth above, the sculpture before mid apex extremely weak, the following tergites very finely trans-striate to reticulate.

Hind tibial spur straight, reaching a little beyond apex of metatarsus.

Head above steel-blue with some bronzy reflection, sometimes blue-green in the reticulations before the ocelli, with upper face largely bronzy and lower face and clypeus blue or blue-green. Antennae blue-green. Sides of thorax and propodeum dull blue and bronzy: mesoscutum very dull blue or bronzy: scutellum blue-green anteriorly in middle, merging to bronzy at sides and behind: propodeum bright blue-green. Gaster very dull bronzy to brownish black, the first large tergite dark blue-green to greenish blue except for a mid apical patch. Legs dark blue-green, the tibiae generally a brighter green, more or less broadly pale at base and apex: tarsi dull stramineous, darkened towards apex.

No lectotype selection has previously been published. The type-material consists of two female specimens on each of two cards. One mount bears a red type label and was put in the type collection: Dr Z. Bouček examined this mount in 1964 and labelled it as bearing different species. The right-hand specimen does not agree with the original description: it is another, secondarily parasitic species which is described below (p. 180). I designate the left-hand specimen as lectotype. Both specimens on the other mount are *agaristae* (Cameron).

Redescribed from the following. AUSTRALIA: N.S.W., Sydney, 3 ♀♀, 28.ii.1903, 'parasite of *Agarista glycine*' (= *Phalaenoides glycinae* Lewin) (*W. W. Froggatt*) (lectotype and paralectotypes); N.S.W., Ryde, 2 ♀♀, 4.iii.1936, 'hyperparasites of *E. agaristae*', *per* Dept. Agric. (det. Ch. Ferrière). INDIA: Maharastra, Nagpur, 2 ♀♀ (1 ♂), 1950, *ex Ophioderes fullonia* (Clerck) (Phalaenidae), *per* E. S. Narayanan, IARI.

### *Pediobius aspidomorphae* (Girault)

This is treated above (pp. 128–131) among the African species, but is, of course, included also in the key to the Asiatic and Australian species studied.

### *Pediobius viridifrons* (Motschulsky)

*Cirrospilus viridifrons* Motschulsky, 1863 : 68. Unique holotype ♀, CEYLON: 'des sommites du mont Patannes' (Zoological Museum of the University, Moscow) [examined].
*Pediobius viridifrons* (Motschulsky) Bouček, 1965 : 553.

Head, seen from above, two and a half times breadth of its median length. Frontovertex nearly two and a half times the dorsal breadth of an eye and about one and a third times breadth of its median length, with ocelli in a right-angled triangle; in greatest part rather dull, with reticulation very distinct × 45, mostly fine though wider-meshed beside the inter-ocellar area, but in about hinder half with broad orbital margins shining and bearing extremely fine reticulation. Sides of upper face finely reticulate. [Eye pilosity not clearly observable in unique type.]

Antenna having scape broadened to near apex, about four times length of its greatest breadth: funicle not broadened in side view, the segments about one and a half times length of their greatest breadth and club almost twice the length of one of them.

Pronotal collar having anterior margin distinct but weakly raised, bearing reticulation that is very fine but quite distinct × 65, its sides distinctly broadened. Notauli very finely and sharply impressed, leading to notaular pits that are about triangular in shape, ill-defined but of moderate depth [what I take to be the seta base about two-fifths the way forward and very near the inner side]: reticulation on mesoscutum strongly outstanding and rather coarse, merging to moderately fine in the notaular pits: hind margin very weakly sinuate. Scutellum rather strongly convex, with reticulation strongly outstanding, strongly elongate in more than anterior half merging to almost rounded, very coarse above and at sides, merging to very much less so near mid line and behind. Propodeum having submedian carinae coalesced at base, whence they diverge rectilinearly and very gently to where they curve round before the nucha, which is broadly and rather weakly emarginate at apex: spiracles oval, not small, about their longer diameter from margin of metanotum, the spiracular area, seen from above, produced into a strong, sharp tooth above the hind coxa.

Petiolar segment, so far as can be observed in the unique type, much as described for *aspidomorphae* Girault (pp. 129–130). Gaster as described for *aspidomorphae* (pp. 129–130 and Text-figs 5–6), but the delicate sculpture on the bronzy part of the first large tergite distinct × 45 and more extensive than in that species, distinct to about half way forward.

[Hind tibial spur not clearly observed.]

Head dark blue-green to greenish blue, with weak bronzy reflections. Antennae similarly coloured. Dorsum of thorax, including pronotal collar, blackish with weak bronzy reflections, the mesopleura blue-green: propodeum medium green to blue. Gaster blackish, the first large tergite broadly blue-green to blue at sides. Legs, so far as can be observed, blue-green, the tarsi stramineous, with the apical segment pale brown.

Redescribed from the unique holotype.

This is obviously very closely related to *aspidomorphae* (Girault) and may later prove to be an aberrant form of that species. I do not, however, believe it to be so, for in a number of features it is outside the range of variation found in the several good series of reared specimens studied. The difference in appearance of the head from above is quite striking, even though measurements of the proportions may seem doubtfully convincing. I am grateful to Dr A. N. Zhelokhovtsev for sending the specimen on loan for study. Specimens of *aspidomorphae* are to be presented to the Zoological Museum of the University, Moscow.

## *Pediobius carinatiscutum* (Girault) **comb. n.**

*Pseudacrias carinatiscutum* Girault, 1917 : 1–2. LECTOTYPE ♀, JAVA: Salatiga (USNM, Washington), here designated [examined].
*Pseudacrias secundus* Girault 1917 : 7. LECTOTYPE ♀, JAVA: Salatiga (USNM, Washington), here designated [examined]. **Syn. n.**
*Pleurotropis carinatiscutum* (Girault) Gahan, 1932 : 750.
*Pleurotropis secundum* (Girault) Gahan, 1932 : 750 (*non* Gahan, 1951).

Head 2·0 to 2·2 times breadth of its median length. Frontovertex little more than dorsal breadth of an eye, its least breadth less than its median length, with ocelli in a very acute triangle, the lateral separated by little more than their longer diameter; having a keel running around inner side of each lateral ocellus from occipital to orbital margin, but only a fine, incomplete median furrow running back from median ocellus; less shining than in *anomalus* (Gahan), though the sculpture very weak and indefinite. Sides of upper face finely transversely striate. Eyes weakly and sparsely hairy; in facial view extending very far below level of toruli, the genal margin almost transverse.

Antenna having scape quite four times length of its greatest breadth: flagellum relatively stouter than in *anomalus* (Gahan) and hardly broadened, the funicle segments much less obviously petiolate at apex, the first about one and a third, the third about one and a quarter, times length of their greatest breadth.

Pronotal collar relatively long as in *anomalus* (Gahan), but evenly emarginate behind. Notauli of the same form as in *anomalus* (Gahan) but more strongly and less sharply impressed laterally and not forming such a sharp margin medially: the smooth, quadrangular notaular pits bear the main seta about one-third the way forward and are separated by a keel that is stouter than in *anomalus* (Gahan) and that tapers from the front: anterior plate of mesoscutum bearing reticulation that is not arranged concentrically and in well-developed specimens is comparatively coarse, smooth along hinder periphery, the parapsides extremely finely striate to reticulate at sides, almost smooth nearer the notaular pits: hind margin hardly sinuate. Scutellum very distinctly longer than broad: in paratypes of *carinatiscutum* (Girault) having longitudinal striation at sides that converges behind, the more or less transverse connecting striae being very sparse and weak and the smooth median band almost percurrent; but in the paratype of *secundus* (Girault) examined the median band extends only about half way back and the striation merges to reticulation behind. Propodeum having submedian carinae closely juxtaposed or even coalesced in about basal half, then diverging at about 45°: nucha relatively longer than in *anomalus* (Gahan), strongly margined at sides and more strongly narrowed: spiracles elongate-oval, small, more than their longer diameter from margin of metanotum, the spiracular area, seen from above, produced into a rounded lobe above the hind coxa.

Petiolar segment not greatly broader at base than long; having a short pair of submedian longitudinal ridges above and a stronger, almost percurrent pair which form an angled separation of the sides from the upper surface, and with reticulation rather fine and regular. First large tergite less than half length of gaster beyond petiole in paratypes of *carinatiscutum* (though slightly more in paratype of *secundus*), the gaster more pointed than in *anomalus* (Gahan), the first large tergite virtually smooth (× 100), the following delicately reticulate to finely trans-striate, with smooth apical margins, more strongly hairy than in *anomalus* (Gahan).

Hind tibial spur almost straight.

Frontovertex mostly red-violet, merging to bronzy before the ocelli, the lower and upper face dull green, the upper face more bronzy on the ridges of the reticulations. Antennae having scape pale testaceous, the pedicellus and flagellum blue-green to red-violet. Thorax and propodeum peacock-blue to, in greater part, red-violet, at sides dark blue-green and bronzy. Gaster dull bronzy to blackish, the first large tergite greenish blue near basal articulation merging to red-violet in more than basal half, and with narrow apical margin greenish blue. Legs blue-green with some red-violet infusion, the tibiae and tarsi mainly dull stramineous, the tibiae with some darkening above, the tarsi darkened only at extreme apex.

In paratype of *secundus* examined, upper face dull brown, antennae dull testaceous, with weak metallic colouring, thorax and propodeum dark blue-green to red-violet, first large tergite of gaster blue-green to red-violet in more than basal half.

Redescribed from the following. JAVA: Salatiga, 3 ♀♀ (on one card), 'From spider's egg-sac. Catalogue No. 20623', paralectotypes of *carinatiscutum* Girault; 1 ♀, 'From egg-case of spider, Salatiga. . . . Catalogue No. 20633', paralectotype of *secundus* Girault. It seems possible that a cocoon mass of a Microgasterine Braconid could have been mistaken for a spider's egg-sac.

At my request, Dr B. D. Burks kindly checked the USNM material of *secundus* (Girault) and *anomalus* (Gahan) with my provisional key to the Asiatic species, females, and also of *carinatiscutum* (Girault) which I deduced might belong to the same complex. He found that Gahan (1951) appeared to have been mistaken in placing his *anomalus* as a synonym of *secundus*, and he arranged the loan of material of all three forms to me. Subsequently to my study of this material, I sent copies of my redescriptions of the species and revised key. He confirmed that my treatment accords with the type and other material in Washington.

As to the selection of lectotypes, Dr Burks writes regarding *carinatiscutum* 'There are 3 specimens mounted on the same card point. The one at the tip of the point should be designated lectotype. There are these labels for all the specimens "20623; Pseudacrias carinatiscutum Girault, ♀ types". I have added a lectotype label.' Regarding *secundus* he writes '*Pseudacrias secundus* Girault has 2 specimens on the same card point; the one at the tip of the point should be designated lectotype. The labels are "Pseudacrias secundus Gir. ♀ types; 20633." I added a lectotype label.' In accordance with his wish I hereby validate these designations.

### ***Pediobius anomalus*** (Gahan) **comb. n., sp. rev.**

(Pl. 5, fig. 10)

*Pleurotropis anomala* Gahan 1920 : 348–9. Holotype ♀, PHILIPPINES: Los Baños (USNM, Washington).

*Pleurotropis anomala* Gahan; Ferrière, 1933 : 96.

[*Pleurotropis secundus* (Girault); Gahan, 1951 : 170. Misidentification.]

[*Pediobius secundus* (Girault) Baltazar, 1966 : 116–7. Misidentification.]

Head, seen from above reniform, extremely little emarginate in front, 2·3 times breadth of its median length. Frontovertex more than twice the dorsal breadth of an eye, with ocelli in a slightly acute triangle, the lateral separated by twice their longer diameter; having a fine median keel from the median ocellus and an even finer keel from the hinder corner of each lateral ocellus running back to the occipital carina; shining, with sculpture for the most part very inconspicuous even on inter-ocellar area, but some weak sculpture fans out from the median keel. Sides of upper face moderately transversely striate-reticulate, more regularly reticulate in lower corners. Eyes very weakly and sparsely hairy; in facial view extending well below level of toruli, the cheeks correspondingly strongly narrowed.

Antenna having scape about four times length of its greatest breadth: pedicellus comparatively slender and funicle very little broadened, the first segment about one and a half, the third about one and a third, times length of their greatest breadth in side view, the segments strongly petiolate at apex.

Pronotal collar relatively long, its hind margin more deeply emarginate in middle third, its sides moderately narrowed and very little rounded. Notauli starting back at about the normal angle, then becoming almost transverse and meeting before the notaular pits, very sharply impressed, the fore part of the mesoscutum before them distinctly raised above the hinder part: notaular pits smooth, quadrangular, bearing the main seta about half the way forward and about one-third the way sideways from the fine median keel that separates them: anterior plate of mesoscutum with fine striation that tends to be concentric around the mid point of its hinder margin, and parapsides with finer striation, much of it directed towards the scutellum: hind margin moderately sinuate. Scutellum very distinctly longer than broad, with longitudinal striation of moderate strength at sides which merges to reticulation behind, broadly in mid line shining, not quite smooth but with very weak reticulation. Propodeum having submedian carinae, as in most species, not closely juxtaposed at base, diverging very slightly at first but then at about 45°, and with no median carina: nucha broadly emarginate at apex: spiracles elongate-oval, comparatively large, not more than their longer diameter from margin of metanotum, the spiracular area seen from above produced into a blunt tooth above the hind coxa.

Petiolar segment much broader than long, with irregular longitudinal ridges of moderate strength in front and with rather fine, irregular reticulation. First large tergite nearly two-thirds length of gaster beyond petiole, the gaster delicately reticulate on hinder part of the first large tergite (*i.e.* not the whole of the dark part), this reticulation clearly visible × 45, and extremely delicately reticulate to trans-striate on those following.

Hind tibial spur straight, extending slightly beyond apex of metatarsus.

Head blue-green to blackish blue, sometimes red-violet before the ocelli (in paratype examined), the lower face dull green, the upper face the same in the meshes, dull brown on the ridges of the reticulations. Antennae blue-green, the flagellum more brown below. Thorax and propodeum bright greenish blue above, with slight brassy, bronzy and red-violet reflection: at sides dull blue-green and blue largely overspread with bronzy. Gaster dull bronzy to blackish, the first large tergite greenish blue above in about basal third. Legs blue-green, the mid and hind tibiae pale testaceous at apex: tarsi dull stramineous, the apical segment darkened.

Redescribed from the following. PHILIPPINES: Luzon, Los Baños, 1 ♀, 1.iii.1918, *ex Endelus bakeri* Kerremans (Col., Buprestidae) (*C. S. Banks*) [USNM paratype no. 22345, mounted on its back, so that dorsum of thorax and abdomen are only visible very obliquely, but head and antennae are clearly visible all round]; Bataan, Lamao, 1 ♀ *ex* larva of *Promecotheca cummingii* Baly (Col., Hispidae) leaf-mining on cocoanut, *per* G. Merino, Bureau of Plant Industry [specimen lacks head but otherwise in good condition]. MALAYA: Johore, 4 ♀♀, iii.1963, *ex* cocoon of *Metisa plana* Walker (Lep., Psychidae) (*B. J. Wood*).

Additional material studied, a male from the last-mentioned series, and the following. PHILIPPINES: Luzon, Manila, 1 ♂, 13.x.1923, *ex* larva *Endelus* sp. (*A. G. Toquero*). JAVA: Tapos, Mt Gedeh, 800 m., 2 ♂♂, vi.1932, '*ex* pupa of Diptera ix in mines of Hispid in Amomum' (*T. H. C. Taylor*). MALAYA: Perak, 1 ♂, 28.v.1954, *ex Crematopsyche pendula* Joannis (*I. J. Wyatt*).

BIOLOGY. This species may be associated with leaf-mining Buprestidae and Hispidae, or may act as a parasite of the Psychidae *Metisa plana* Walker and *Crematopsyche pendula* Johannis, which feed on oil palms. In the latter case it may be highly gregarious, and there is no suggestion of its being a secondary parasite (see Wood, 1966 pp. 12, 15, 21–2, Sankaran, 1970 p. 52).

## **Pediobius fraternus** (Motschulsky)

(Text-fig. 11)

*Eulophus fraternus* Motschulsky, 1859 : 118. Syntypes, sex not specified but evidently ♀, Ceylon: Colombo (Zoological Museum of the University, Moscow).
*Eulophus mantiechthrus* Motschulsky, 1859 : 117. Syntypes ♂, Ceylon: Colombo (Zoological Museum of the University, Moscow) [examined]. **Syn. n.**
*Eulophus fraternus* Motschulsky; Schmiedeknecht, 1909 : 415.
*Eulophus mantiechthrus* Motschulsky; Schmiedeknecht, 1909 : 416.
*Pleurotropis fraternus* (Motschulsky) Gahan, 1925 : 102, ♀.
*Pediobius mantiechthrus* (Motschulsky) Bouček, 1965*b* : 553.
*Pediobius fraternus* (Motschulsky) Baltazar, 1966 : 116.

Head, seen from above (Text-fig. 11), sub-globose, not sharply narrowed behind eyes, twice or just over the breadth of its median length. Frontovertex longer medially than broad and 1·2 to nearly 1·5 times the dorsal breadth of an eye, with ocelli in a strongly acute triangle and relatively small; dull, finely and regularly reticulate, with the meshes more transverse before the frontal fork, beside and behind the lateral ocelli rather dull, the reticulation weaker but distinct. Sides of upper face rather finely reticulate, the meshes stretched downward: lower face and clypeus very finely but distinctly reticulate, rather dull. Eyes not distinctly hairy × 100.

Antenna having scape five to six times length of its greatest breadth: funicle little broadened, having first segment about quadrate or slightly broader than long in side view, and second and third very distinctly transverse: club excluding terminal spine equal to combined length of second and third funicle segments.

Pronotal collar with fore and hind margins usually almost parallel, with sides very strongly narrowed, its anterior margin very distinctly raised, the reticulate microsculpture much more strongly outstanding on neck than behind it. Notauli varying from very distinct to hardly distinct anteriorly: notaular pits shallow, not bordered on inner or outer side, and bearing the main seta rather near the inner hind corner: mesoscutum rather finely reticulate on mid lobe, more finely so at sides and in notaular pits, weakly emarginate at apex. Scutellum weakly convex, decidedly broader than long, finely longitudinally striate-reticulate throughout. Propodeum having submedian carinae subparallel about half way back, then divergent at plainly less than 45°, and usually with no median carina: nucha very weakly developed, deeply emarginate: spiracles sub-circular to short-oval, the spiracular area, as seen from above, produced almost rectangularly above the hind coxa.

Petiolar segment broader than long, with anterior margin very strongly raised in middle, very finely reticulate and with longitudinal ridges that are of moderate strength and rather irregular but are percurrent or almost so. First large tergite about three-fifths length of gaster beyond petiole, almost smooth: following tergites duller, bearing comparatively strong hairs.

Hind tibial spur straight, reaching a little beyond apex of metatarsus.

Head above dark blue-green, almost entirely overspread with dull bronzy; before median ocellus and on upper and lower face a much brighter blue-green, with brassy and often coppery reflections. Antennae pale brown, often with weak metallic green reflections. Thorax above and at sides, and sides of propodeum blackish brown: scutellum towards apex or sometimes more extensively blue-green, the propodeum above blue-green often with bright bronzy reflection in median area or sometimes with more extensive red-violet reflection. Gaster very dull bronzy, blue-green to violet only at base of first large tergite. Legs mostly a rather bright blue-green, all tibiae pale at apex: tarsi stramineous, often only slightly darkened at apex.

Redescribed from the following. India: Mysore, Bangalore, 2 ♀♀, viii.1970, *ex* Mantid ootheca, *per* CIBC. Thailand: unlocalized, 3 ♀♀, 1965, '*ex* eggs of Mantid', *per* Dept. Agric. West Malaysia: Selangor, Kuala Lumpur, 3 ♀♀, 27.xii.1946, 'emerging from Mantid ootheca' (*R. A. Lever*). SUMATRA: E., Asahan, 50–60 m., 6 ♀♀, 1934–36, 'from Gambir-pests' (*F. Schneider*). HONG KONG: New Territories, Tai Lung, 2 ♀♀, 14.i.1966, '*ex* eggs of praying mantis', *per* Agriculture and Fisheries Department. TAIWAN: Taihoku, 4 ♀♀, '*ex* egg-mass *Paratenodera auridifolia*' (*T. Shiraki*) (including two Crawford homotypes).

Motschulsky (1859) wrote that he had received this species in numbers from Ceylon, and postulated the host as being Mantid eggs. The host-record cited by Gahan (1925) for the Philippine specimen seems doubtful.

Through the good offices of Dr B. D. Burks, I had on loan the material from Taiwan, including the two Crawford homotypes. Dr Burks told me it is not known that Crawford ever visited Moscow, but it is known that Kurdjumov visited Washington, and it is to be supposed that he had the syntypes of *fraternus* Motschulsky with him. Professor G. A. Viktorov very kindly brought the syntypes of *mantiechthrus* Motschulsky with him on a visit to England. These consist of seven specimens mounted on one card, all of them males. I have compared them with the series from Hong Kong, Thailand and Sumatra, including a male specimen from each country, and find them to be conspecific with *fraternus*. I do not wish to select any one specimen as lectotype.

Since the female is the better characterized sex and the name *fraternus* has come into use, I select this as the valid name for the species under the provisions of the International Code, Article 24 sections (a) and (b) (ii).

This is similar in appearance to but quite distinct from the African species reared from Mantid oothecae. The two may be distinguished as follows:

Frontovertex decidedly narrowed from behind to near front (Text-fig. 11), with microsculpture finer and more regular: lateral ocelli plainly less than their longer diameter from orbital margin: reticulation on lower face and clypeus markedly more distinct: antennal funicle in side view little broadened: anterior margin of pronotal collar very distinctly raised, the reticulate microsculpture much more strongly outstanding on neck than behind it: scutellum slightly more convex, finely longitudinally striate-reticulate throughout, the transverse much weaker than the longitudinal ridges: petiolar segment having anterior margin very strongly raised in middle, and having longitudinal ridges more numerous and conspicuous . . ***fraternus*** (Motschulsky)

Frontovertex roughly parallel-sided opposite inter-ocellar area, with microsculpture markedly less fine and regular: lateral ocelli little less than their longer diameter from orbital margin: reticulation on lower face and clypeus markedly less distinct: antennal funicle in side view moderately broadened: anterior margin of pronotal collar very weakly raised and not delimiting a sharp difference of sculpture: scutellum markedly flatter, longitudinally reticulate medially, more striate-reticulate at sides: petiolar segment having anterior margin sharply raised throughout, as seen from above, but not strongly so in middle, and having longitudinal ridges less numerous and conspicuous ***modestus*** (Masi)

## *Pediobius soror* sp. n.

(Text-fig. 12)

Head, seen from above, about two and a half times breadth of its median length. Frontovertex a little broader than its median length and over one and a half times the dorsal breadth of an eye, with ocelli in about a right-angled triangle and sometimes relatively large; having fine keels running back from each ocellus and sideways from each lateral ocellus (Text-fig. 12); dull, finely and regularly reticulate, with the meshes more transverse before the frontal fork, smooth and shining beside and behind the lateral ocelli. Sides of upper face moderately reticulate. Eyes rather finely and sparsely hairy; in facial view extending well below level of toruli.

Antenna having scape elongate and narrow, about seven times length of its greatest breadth: funicle not broadened, the segments all about or nearly twice length of their greatest breadth in side view and distinctly petiolate at apex.

Pronotum having lateral angles prominent, as in *saulius* (Walker) (Bouček, 1965, pp. 11, 35–36) and in *coffeicola* (Ferrière), the collar with hind margin slightly more deeply emarginate in about middle third and consequently relatively short in mid-line, its sides moderately rounded and moderately to strongly narrowed. Notauli fine and sharply impressed, their sharp anterior margin continuing as an inner margin that runs about half way back the notaular pits; these bear deep, dull bronzy longitudinal impressions, are not bordered on outer side, and bear the main seta near the inner edge about half way forward, and are separated by a space about equal to the distance from their inner margin to the outer margin of the longitudinal impression. Mid lobe of mesoscutum with reticulation of moderate strength and rather regular, and parapsides more finely striate to reticulate: hind margin rather sharply emarginate in middle. Scutellum having longitudinal striations of moderate strength in greater part, merging to reticulation behind. Propodeum having submedian carinae close and more or less parallel in about basal half, often incurved or very slightly divergent, then diverging at much more than 45°, and with no median carina: nucha shining, well rounded at apex: spiracles elongate-oval, the spiracular area, seen from above, produced into a blunt tooth above the hind coxa.

Petiolar segment much broader than long, with anterior margin strongly raised, with irregular longitudinal ridges which are not percurrent, and with reticulation fine to rather fine. First large tergite rather over half length of gaster beyond petiole, comparatively strongly reticulate on bronzy part, the following tergites much more delicately reticulate on the bronzy part.

Hind tibial spur curved, reaching well beyond apex of metatarsus.

Frontovertex mostly red-violet before the ocelli, dark blue-green and bronzy between and behind them: upper face very dark blue-green, the ridges of the reticulations dark and lower face and clypeus dark blue-green to blue. Antennae having scape and pedicellus strongly blue-green, and flagellum more weakly blue-green or pale brown with weak metallic reflections. Thorax and propodeum above blue-green, with blue and red-violet or occasionally bronzy reflections, at sides duller. Gaster comparatively bright bronzy, the first large tergite bright blue-green to red-violet in about basal two-thirds, this and the following tergites with apical margins smooth, sea-green. Legs in greater part dark blue-green, the tibiae usually a brighter green, the mid and hind tibiae often pale at apex: tarsi pale stramineous, the apical segment darkened.

Holotype ♀. BURMA: Insein, Kystpyngan Reserve, 27.ii.1939, *ex Pyrausta machaeralis* Walker (Pyraustidae) (*M. H. Desai*) *per* J. C. M. Gardner (BMNH).

Paratypes. BURMA: 1 ♀, same data as holotype. SUMATRA: E.C., Pematang Siantar, Mardjandi Estate, 2500′, 6 ♀♀, 10.ii.1932, *ex* moth pupa on *Deguelia* sp. (*R. I. Nel*). Two males are present in the series from Burma.

## *Pediobius stenochoreus* sp. n.

Head broad, two and a quarter to two and a half times breadth of its median length. Frontovertex less than twice the dorsal breadth of an eye and not much more than its median length, with ocelli in about or less than a right-angled triangle, the lateral separated by about twice their longer diameter, having fine keels running sideways and back from lateral ocelli but a mere indication of a furrow back from median ocellus; dull, finely and regularly reticulate in greater part, with the meshes more transverse before the frontal fork, but beside and behind the lateral ocelli shining, with reticulate sculpture very much weaker. Sides of upper face rather strongly transversely striate-reticulate above, more regularly reticulate below. Eyes rather finely and sparsely hairy, in facial view extending far below level of toruli.

Antenna having scape about four times length of its greatest breadth: flagellum slightly broadened in side view, the first segment nearly twice, the third about one and a third, times length of their greatest breadth, the segments very distinctly petiolate at apex.

Pronotal collar of normal relative length, its sides rather strongly narrowed. Notauli deeply impressed anteriorly, then running as very fine impressions to the outer anterior corners of the notaular pits; these sharply margined, straight-sided on outer and strongly curved on inner side, smooth, bearing the main seta rather nearer the hinder and inner sides, and separated by a space about one-third the width of either: mesoscutum moderately transversely striate-reticulate on mid lobe, more weakly longitudinally so on parapsides merging to reticulate at sides: hind margin gently curved behind the notaular pits, sharply emarginate between them. Scutellum longitudinally striate, merging to striate-reticulate behind, this sculpture much coarser than on mesoscutum, but narrowly in mid line in anterior half more finely sculptured. Propodeum having submedian carinae sub-parallel in about basal half and sometimes closely juxtaposed, then diverging at about 45°: nucha rather long, sharply margined at sides: spiracles elongate-oval, the spiracular area, seen from above, produced into a rounded lobe above the hind coxa.

Petiolar segment much broader than long, with anterior margin strongly raised into a tongue-like projection, finely to very finely reticulate, with a pair of strong longitudinal ridges at sides but without or only with traces of ridges above. Proportions of gaster beyond petiole varying, the first large tergite rather over half its length in the less elongate and pointed, much less than half in the more elongate and pointed specimens: first large tergite very delicately or occasionally comparatively strongly reticulate on the bronzy part, the following very finely reticulate to trans-striate, with smooth apical margins.

Hind tibial spur slightly curved, reaching well beyond apex of metatarsus.

Frontovertex dark blue-green, sometimes red-violet before the median ocellus: lower face dark blue-green, and upper face the same, but dull bronzy on the ridges of the reticulations or wholly dull bronzy. Antennae dark blue-green. Thorax and propodeum dark blue-green, sometimes with bronzy or slight red-violet reflections, at sides dark blue-green, largely overspread with bronzy. Gaster brownish black, the first large tergite greenish blue in more than basal half, sometimes tinged with red-violet, the following tergites often with fine apical margins sea-green. Legs blue-green to dark blue, the tarsi stramineous, with the apical segment wholly or mostly fuscous.

Holotype ♀. PAKISTAN: Rawalpindi, Shawal, x.1970, *ex Lithocolletis* sp. (Gracilariidae), *per* CIBC (BMNH).

Paratypes. PAKISTAN: 2 ♀♀, same data as holotype; Khoongi, 1 ♀, 10.x.1963, *ex* cocoon probably *Apanteles* sp. on *Populus nigra*, *per* CIBC. INDIA: Uttar Pradesh, Dehra Dun, 1 ♀, 3.i.1929, parasitic on larva of *Nephopteryx rhodobasalis* Hampson (Phycitidae) (*S. N. Chatterjee*). A small male specimen, reared together with the female from Dehra Dun, has the reticulate sculpture on the frontovertex not distinct.

## ***Pediobius painei*** (Ferrière) **comb. n.**

*Pleurotropis painei* Ferrière, 1933 : 94–6. Holotype ♀, JAVA: Poerwaredjo (BMNH) [examined].
*Pleurotropis painei* Ferrière; Taylor, 1937: 158–60.

Head, seen from above, two and a quarter times or less the breadth of its median length. Frontovertex relatively narrow, about as broad as its median length and about one and a half times the dorsal breadth of an eye, with ocelli in a very decidedly acute triangle; shining, with reticulation for the most part indistinct × 65 though in and behind inter-ocellar area very fine but regular. Sides of upper face, in female only, shining, the sculpture indistinct or very weak. Eyes rather weakly and sparsely hairy, very distinctly so × 45; in facial view relatively strongly emarginate, extending very distinctly below level of toruli, the cheeks correspondingly strongly narrowed.

Antenna having scape narrow at base, very distinctly broadened to near apex, yet about six times length of its greatest breadth: funicle (Ferrière, 1933, fig. 5a) having all segments, in side view, ovate, distinctly longer than broad, shortly petiolate at apex, bearing hairs a little longer than the breadth of the segment that bears them.

Pronotum having lateral angles prominent, as in *saulius* (Walker) (Bouček, 1965, pp. 11, 35–36) and in *coffeicola* (Ferrière), the collar strongly contracted and rounded at sides behind its sharp anterior margin. Notauli not sharply impressed anteriorly or medially, running to smooth, almost quadrangular notaular pits of moderate depth, that are sharply margined anteriorly and bear the main seta about one-quarter the way back, the space between them a little narrower than a pit: sculpture of mesoscutum rather weak, consisting of reticulation that on mid lobe is rather wide-meshed but on parapsides is much narrower-meshed, merging to fine striation at sides: hind margin weakly sinuate. Scutellum weakly convex, having rather weak longitudinal striation at sides which merges to reticulation behind, and having indistinct reticulation on a broad median band that extends about two-thirds the way back. Propodeum having submedian carinae subparallel for more than half way back, then diverging at more than 45° and with no distinct median carina: nucha moderately convex: spiracles oval, the spiracular area produced into a small blunt ridge.

Petiolar segment stout, much broader than long, with a strong anterior flange that covers the apical part of the nucha, with longitudinal ridges weak and incomplete above but strong and complete at sides. First large tergite nearly two-thirds length of gaster beyond petiole: sculpture on dark part of first large tergite very weak and quite indefinite, and on those following extremely delicate.

Hind tibial spur straight, very nearly reaching ventral apex of metatarsus.

Head bright green to blue-green, sometimes with brassy reflection, dull bronzy on and behind inter-ocellar area, red-violet before the ocelli: upper and lower face bright green, with strong brassy to bronzy reflection. Antennae greenish blue. Thorax bronzy anteriorly, merging to blue-green and greenish blue: propodeum a brighter blue-green. First large tergite blue-green, with red-violet reflection in basal half or more, dull bronzy beyond: remainder of gaster dull bronzy, but the last visible tergite and ovipositor sheaths sometimes blue-green. Legs blue-green, or in part red-violet, the tibiae paler towards apex, and the tarsi dull stramineous, darkened towards apex.

Redescribed from the following. JAVA: Poerwaredjo, 7 ♀♀ (including holotype and 5 paratypes), iii.1930, '*ex Promecotheca* sp. internal parasite of pupa' (*R. W. Paine*). Three male paratypes are present in the series. Material recorded by Taylor (1937) as reared from other Hispid hosts has not been traced.

## ***Pediobius*** species, ***imbreus*** group

Like the African *afronigripes* group, these are related to the palaearctic species *pyrgo* Walker. *P. pyrgo* differs from all in having the head less narrowed behind eyes, the frontovertex with reticulation generally very distinct × 45 as in *afronigripes* nom. n. though somewhat finer, and the hind tibial spur extending very little beyond apex of the corresponding metatarsus. A further character additional to those given by Bouček (1965) for the separation of *waterstonii* (Masi) is the very slender antennal scape: *pyrgo* has the eyes much more strongly hairy than in the remaining species, and the sculpture of the mesoscutum, though of the same general pattern, stronger than in any except the Australian species described below. *P. pyrgo* has the antennal flagellum markedly more strongly broadened in side view than in *imbreus* Walker and is not brightly coloured and shining like the parasite of *Erionota*.

## ***Pediobius erionotae* sp. n.**

(Text-fig. 10)

Head, seen from above, about two and a half to two and two-thirds times breadth of its median length, rather deeply emarginate behind (Text-fig. 10). Frontovertex about one and a third times breadth of its median length and twice the dorsal breadth of an eye, with ocelli in a very slightly acute triangle; shining, with reticulation irregular, for the most part indistinct × 65 though more distinct on inter-ocellar area. Sides of upper face rather weakly reticulate. Eyes rather shortly and sparsely hairy, just distinctly so × 25.

Antenna having scape narrow, six times length of its greatest breadth; funicle strongly broadened, the first segment up to twice as long as broad in side view (this proportion somewhat variable) and third a little broader than long, the segments distinctly petiolate at apex.

Sides of pronotal collar slightly rounded and slightly to moderately narrowed. Notauli sharp and fine, running to the rather shallow notaular pits, which are not margined on inner or outer side, and which bear stronger longitudinal impressions and the main seta just inward of those and rather more than a third the way forward; sculpture of mesoscutum much as described for *imbreus* Walker; hind margin moderately sinuate. Scutellum having a very broad percurrent median band almost smooth and very shining, with wide-meshed reticulate sculpture scarcely discernible × 65, rather longitudinally striate-reticulate to either side of this. Propodeum having submedian carinae rather weakly and regularly diverging from base, curving very slightly outward, and with a fine but distinct median carina: nucha well developed, shining and rather strongly convex, very weakly emarginate at apex: spiracles oval, the spiracular area, seen from above, produced into a rather sharp tooth above the hind coxa.

Petiolar segment broader than long, with anterior margin rather strongly raised, finely to very finely reticulate and with weak or rather weak and irregular longitudinal ridges which are not nearly percurrent. First large tergite rather over half length of gaster beyond petiole: reticulation on bronzy part of gaster extremely delicate, hardly distinct × 65.

Hind tibial spur curved, extending well beyond apex of metatarsus. Head blue-green to blackish blue, with greater or lesser amount of red-violet and bronzy. Antennae blue-green. Thorax and propodeum above bright blue-green, blue and red-violet, at sides blue-green and bronzy, the pronotum before collar bronzy. Gaster bright pale bronzy, the first large tergite bright blue-green to red-violet in about basal two-thirds. Legs in greater part dark blue-green, often extensively tinged with blue to red-violet, the tibiae usually a brighter green: tarsi stramineous, the apical segment darkened.

Holotype ♀, West Malaysia: Negri Sembilan, Jelebu, 12.i.1938, *ex* ova of *Erionota thrax* L. (Hesperiidae), *per* Divn. Ent. Dept. Agric. (BMNH).

Paratypes. West Malaysia: Negri Sembilan, Jelebu, 5 ♀♀, same data as holotype; Pahang, Sungei Tua, 5 ♀♀, 31.vii.1928, *ex* ova *Erionota thrax* L. (*G. H. Corbett*). Java: Siloewok, Sawangan estate, 2 ♀♀, 18.viii.1938 (*H. Duyvendijk*). Borneo: Sabah, Inanan, 2 ♀♀, 18.iv. and 19.viii.1970, *ex* ova of *Erionota thrax* L.; 5 ♀♀, 21.vii.1970, *ex* larvae of *Erionota thrax* L.; Tuaran, 1 ♀, 9.ii.1971, *ex* cocoon *Apanteles* *erionotae* Wilkinson (Braconidae), 1 ♀, 22.iii.1971, 'ex unknown parasite pupa *ex E. thrax* larva', *per* CIBC.

BIOLOGY. Clearly this requires further investigation. That the species has been reared from either ova or larvae may be understood if it should have such biology as that described by Taylor (1937, pp. 161–2) for *Achrysocharis promecothecae* Ferrière, which attacks only eggs in which the development of the embryo is already well advanced, and thus may emerge from either egg-shell or young larva. That it should also have been reared from a cocoon of *Apanteles*, which is a larval parasite, is very unexpected.

### ***Pediobius waterstonii*** (Masi)

*Pleurotropis Waterstonii* Masi, 1929 : 231–6. Holotype ♀, LIBYA: Giarabub (MCSN, Genoa).
*Pediobius obtusiceps* Bouček, 1965 : 10–11, 47–8. Holotype ♀, CZECHOSLOVAKIA: Prague (Národní Museum, Prague).
*Pediobius waterstonii* (Masi) Bouček, 1970 : 95.

Since this species has been treated extensively by Masi (1929) and by Bouček (1965), only an abbreviated description is given here.

Head, seen from above, up to nearly three times breadth of its median length, rather weakly emarginate behind. Frontovertex with ocelli in a right-angled or obtuse triangle; in greater part shining, with reticulation not distinct (in *pyrgo* (Walker) generally almost as distinct as in *afronigripes* nom. n.). Sides of upper face weakly reticulate (in *pyrgo* with reticulation rather fine but rather strongly outstanding). Eyes rather weakly but moderately densely hairy, distinctly so × 45.

Antenna having scape elongate and narrow, about eight times length of its greatest breadth (in *pyrgo* more rounded beneath, hardly five times): funicle moderately broadened in side view, the third segment about quadrate (in *pyrgo* strongly broadened, the third segment much broader than long).

Pronotal collar not, as stated by Masi, particularly short and without anterior margin, its sides moderately narrowed. Mesoscutum having reticulation much as in closely related species (see Bouček, 1965, fig. 33). Scutellum longitudinally striate, merging to longitudinally reticulate behind, having a narrow median band with the sculpture very much weaker. Propodeum having no median carina in the material cited below (cf. Bouček, 1965, fig. 33): nucha moderately convex and moderately emarginate at apex: spiracular area, seen from above, produced into a small tooth above the hind coxa.

First large tergite less than half length of gaster beyond petiole, very delicately reticulate in middle of about apical half, the following tergites extremely delicately reticulate to trans-striate.

Gaster dark bronzy to blackish, with very little green coloration at base of first large tergite. Legs steely green to brighter green, the tarsi whitish with the apical segment infuscate.

Material studied. SAUDI ARABIA: Riyadh, 1 ♀, 29.iv.1970, '*ex* gall moth', *per* U.N. Development Programme. PAKISTAN: Kabirwala, 2 ♀♀ (1 ♂), 29.ix.1971, *ex Pectinophora gossypiella* Saunders (Gelechiidae), *per* CIBC.

I am grateful to my colleague Dr Z. Bouček for confirming my placement of the specimen from Saudi Arabia and lending me a Spanish specimen for comparison.

## *Pediobius pieridis* sp. n.

Head, seen from above, broad, about three times breadth of its median length, very weakly emarginate behind. Frontovertex over one and a half times breadth of its median length and over twice the breadth of an eye, with ocelli in a slightly to markedly obtuse triangle; dull, with reticulation fine to very fine and, except in middle of inter-ocellar area, rather indistinct, but beside and behind the lateral ocelli shining. Sides of upper face rather weakly and rather finely reticulate, the reticulation diagonally directed. Eyes rather sparsely hairy, distinctly so × 25.

Antenna having scape nearly five times length of its greatest breadth: funicle strongly broadened in side view, the first segment little longer than broad, the third one and a third times as broad as long, the segments strongly petiolate at apex.

Pronotal collar relatively short, with some weak to moderate longitudinal striae, having sides little rounded and slightly to moderately narrowed. Mesoscutum not markedly narrowed at sides, but, behind the anterior angle, somewhat rounded or almost parallel-sided, the parapsides separated from the median lobe by deep impressions, the fine notauli running to rather shallow notaular pits which bear the main seta about one-third the way forward: sculpture much as described for *imbreus* Walker but stronger: hind margin rather strongly sinuate. Scutellum having longitudinal striation percurrent and rather strong, and a narrow median band with the sculpture much weaker to indistinct. Propodeum having submedian carinae diverging gently and regularly from base, and with no distinct median carina: nucha moderately convex and moderately emarginate at apex: spiracles small, oval, the spiracular area, seen from above, produced into a strong tooth above the hind coxa.

Petiolar segment somewhat broader at base than long, with anterior margin not strongly raised, finely or rather finely reticulate, and with short, weak longitudinal ridges not far behind anterior margin. First large tergite about half length of gaster beyond petiole, delicately reticulate on less than apical half, the following tergites extremely finely trans-striate before the finely reticulate apical hind margins.

Hind tibial spur curved, extending well beyond apex of corresponding metatarsus but not to mid point of second tarsal segment.

Head black to blue-black, the upper face with overspread of bronzy, the lower face, lower genae and clypeus very dark blue-green. Antennae blue-green. Coloration of thorax and propodeum much as described for *imbreus* Walker. Gaster blackish, without apparent green coloration. Leg colour as described for *imbreus* Walker.

Holotype ♀. AUSTRALIA: ACT, Canberra, 1 ♀, 23.ii.1950, *ex* pupa of *Pieris rapae* (L.) (*F. Wilson*) (ANIC, Canberra).

Paratypes. AUSTRALIA: 4 ♀♀, same data as holotype; Canberra, 1 ♀, 10.vii.1950, *ex* cocoon of *Plutella xylostella* (L.) (= *maculipennis* (Curtis)) (*F. Wilson*); N.S.W., Sydney, 1 ♀, 28.ii.1903, 'parasite of *Agarista glycine*' (= *Phalaenoides glycinae* Lewin) (*W. W. Froggatt*). Paratypes in BMNH and ANIC, Canberra.

Mr Frank Wilson informs me that he regarded this species, determined in 1951 as *Pleurotropis* sp., as a secondary parasite, probably through *Pteromalus puparum* L. in the case of those reared from *Pieris* and through *Thyraeella collaris* (Gravenhorst) in the case of that reared from a *Plutella* cocoon. The specimen reared by W. W. Froggatt is mounted on the same card as the lectotype of *P. agaristae* (Cameron) and is probably secondary through that species.

Two males are present in the series reared from *Pieris:* in facial aspect they are bright blue-green, with the reticulation on sides of upper face much finer and not diagonally directed.

### ***Pediobius imbreus*** Walker

(Text-fig. 14)

*Entedon* (*Pediobius*) *imbreus* Walker, 1846 : 184–5. Syntypes ♀, INDIA: Bombay (UM, Oxford) [examined].

*Pleurotropis detrimentosus* Gahan, 1930 : 9–10. Holotype ♀, INDIA: Tamil Nadu (= Madras), Palur (USNM, Washington).

*Pleurotropis detrimentosus* Gahan; Ferrière, 1933 : 94–6.

*Pleurotropis detrimentosus* Gahan; Taylor, 1937 : 163–4, 184.

*Pleurotropis detrimentosus* Gahan; Van der Vecht, 1950 : 59–61, fig. 19a, p. 60.

*Pediobius imbreus* Walker; Kerrich, 1970*a* : 89–90.

Head, seen from above, about two and a half times breadth of its median length, rather weakly emarginate behind. Frontovertex about one and a third or less the breadth of its median length and twice the dorsal breadth of an eye, with ocelli in a slightly acute triangle; shining, with reticulation irregular, generally for the most part indistinct × 65 though in inter-ocellar area distinct × 45. Sides of upper face moderately reticulate. Eyes very weakly and sparsely hairy, just distinctly so × 65.

Antenna having scape about four times length of its greatest breadth: funicle (Ferrière, 1933, fig. 5b) distinctly broadened in side view, the first segment one and a half times or more the length of its greatest breadth, the third distinctly broader than long, the segments distinctly petiolate at apex.

Sides of pronotal collar moderately narrowed. Notauli sharp and very fine, continuing as fine impressions in the shallow notaular pits, which are not margined in front or at sides, and bear the main seta about one-third the way forward: mesoscutum shaped as in Text-fig. 14, weakly sculptured, reticulate in middle of mid lobe, otherwise striate-reticulate, most strongly so beside the notaular pits, the sculpture just comfortably distinct × 25, but much more strongly reticulate at sides of parapsides: hind margin moderately sinuate. Scutellum longitudinally striate at sides, merging to striate-reticulate behind the bristle, and having a usually broad median band, which is percurrent or almost so, generally shining, with sculpture absent or indistinct. Propodeum having submedian carinae diverging almost regularly from base at very much less than 45°, and with median carina usually very distinct: nucha rather strongly convex, narrowly but rather deeply emarginate at apex: spiracles short-oval, the spiracular area as seen from above produced into a prominent sharp tooth above the hind coxa.

Petiolar segment much broader than long, finely reticulate, usually having longitudinal ridges that mostly are percurrent, but are not strong or regular. First large tergite about half length of gaster beyond petiole, which is elongate-ovate, delicately reticulate on dark part of first large tergite, extremely delicately reticulate to trans-striate on those following.

Hind tibial spur strongly curved and long, almost reaching apex of second tarsal segment.

Normal coloration—frontovertex blackish or blue-black, with dark blue-green beside and behind lateral ocelli, often extending further forward: genae blackish, merging to dark blue-green on lower face and clypeus, the upper face bronzy. Antennae blue-green. Thorax above blackish, the pronotal collar bright blue-green, the propleura dark blue-green, the mesopleura dark blue-green above, bronzy below: propodeum bright blue-green above, darker below. Gaster dark bronzy to blackish, the first large tergite with blue-green coloration on about basal half or, more usually, less. Legs blue-green, or in part steely blue, the tarsi whitish, with the apical segment infuscate.

One specimen has the whole head and upper surface of the mesothorax a moderately bright blue-green: it was reared in Java by R. W. Paine in the same series as others with normal coloration.

Redescribed from the following. INDIA: Gujurat, Junagadh, 1 ♀, i.1968, 3 ♀♀, 1969, *ex* larva and *ex* pupa of *Nephantis serinopa* Meyrick (Xyloryctidae) on cocoa, *per* R. M. Patel; Mysore, Bangalore, ♀, xii.1969, *ex N. serinopa* (*N. B. Nayak*).

CEYLON: Batticaloa, 2 ♀♀, ix.1962, *ex* pupa of *Parasierola nephantidis* Muesebeck, E. Dharmaraju. WEST MALAYSIA: Prov. Wellesley, 8 ♀♀, 7.ii.1936, *ex* indet. lepidopterous larva (*G. H. Corbett*); Johore, Layang, 3 ♀♀, 1963, *ex Metisa plana* Walker, 2 ♀♀, iii.1963, *ex Crematopsyche pendula* Joannis (*B. J. Wood*). JAVA: Poerwaredjo, numerous ♀♀, iii.1930, secondary parasite of *Promecotheca nuciferae* Maulik (Hispidae) (*R. W. Paine* )(see Taylor, 1937); Res. Kedu, numerous ♀♀, 1939, *ex Apanteles artonae* Rohwer on *Artona catoxantha* (Hampson) (Zygaenidae) (*J. van der Vecht*). Males are included in most of the series.

Walker's three female syntypes from INDIA: Bombay, were reared, presumably as secondary parasites, from *Epicephala chalybacma* Meyrick (Gracillariidae) (see Kerrich, 1970*a*). They have been compared with the above description.

Gahan (1930), describing the species from material reared as a secondary parasite of *Nephantis serinopa* Meyrick through *Parasierola* sp. (Bethylidae), described the scutellum as having a 'broader' percurrent smooth and polished median area, which is the normal condition in this species. Curiously, some specimens reared from the same primary host and submitted by Dr R. M. Patel have this median area narrower and duller, but I regard them as belonging to the same species. There is some variation in this character.

BIOLOGY (see especially Taylor, 1937; Van der Vecht, 1950). This species is commonly reared as a secondary parasite. Taylor, who handled a very large amount of living material, found it to be exclusively secondary except that occasionally it could act as a tertiary parasite through *Achrysocharis orientalis* (Ferrière). Wood (1966, p. 21), however, found that it appears occasionally to act as a primary parasite in association with Psychidae.

### ***Pediobius parvulus*** (Ferrière) **comb. n.**

(Text-fig. 15)

*Pleurotropis parvulus* Ferrière, 1933 : 94–6. Holotype ♀, JAVA: Poerwaredjo (BMNH) [examined].
*Pleurotropis parvulus* Ferrière; Taylor, 1937 : 160–1, 180–225.

This species is structurally very similar to *imbreus* Walker, but has been shown conclusively by Taylor (1937) to be biologically distinct.

Found to differ from *imbreus* Walker as follows: sides of upper face with reticulation weak and rather wide-meshed. Eyes quite distinctly hairy × 65, *i.e.* rather more strongly hairy than in *imbreus*. Antenna having first funicle segment, in side view, hardly longer than broad. Sides of pronotal collar rounded, hardly narrowed, and sides of mesoscutum less sharply angled (Text-fig. 15): mesoscutum otherwise as described for *imbreus*, though the sculpture weaker. Scutellum very much as in *imbreus*, though the shining median band is less well marked, especially anteriorly, the lateral striation not stopping far short of the apex, as would be indicated from Ferrière's fig. 6c, though it may appear so if viewed from above with the light directed from in front. First large tergite well over half length of gaster beyond petiole, which is ovate, extremely weakly sculptured, relatively shorter than in *imbreus* Walker so that the wings extend further beyond its apex. Very little green coloration on first large tergite.

This species is structurally very similar to *imbreus* Walker, and in order to ensure correct identification, the above diagnosis was made originally from the holotype and female paratypes only: male paratypes are included in the series. It appears to be the relative length of the gaster rather than the proportion of the wings in which it differs from *imbreus*.

Taylor (1937) recorded that the pupa of *parvulus* had a bluish sheen. He figured (p. 184) the ventral thoracic plates of the pupa of this species and of '*detrimentosus*', but I have been unable to correlate the difference adduced with the corresponding adult structures.

The following additional material has since been rechecked or determined. SINGAPORE: 2 ♀♀, 8.ix.1971, *ex Promecotheca* sp., gregarious pupal parasite, *per* D. H. Murphy, Dept. Zool. University; Sims Avenue, 1 ♀, 26.vi.1951 (*R. A. Lever*). NEW BRITAIN: Vunakanan, Gazelle Peninsula, 1 ♀, 16.v.1956, 'laying in mature larva *Promecotheca*' (*J. L. Gressitt*). FIJI: 1 ♀, viii.1971, *ex Promecotheca* sp., 2 ♀♀, 1971, *ex Agonoxena* sp. (Agonoxenidae), *per* CIBC.

A few specimens have been received from Ceylon, Peradiniya, from Dr H. E. Fernando, who wrote that the species had been introduced for the control of *Promecotheca cummingii* Baly. Dr D. Mariau has written that the species has been introduced to the Ivory Coast to assist in the control of *Coelaenomenodera elaidis* Maulik but that the introduction did not appear to be successful: however, in case it should later prove to have established, it is included in the African as well as the Asiatic key to species.

### KEY TO THE FEMALES OF THE SOUTHERN ASIATIC AND AUSTRALIAN SPECIES STUDIED

1 Head well rounded and not strongly narrowed behind eyes (Text-fig. 9): occipital carina completely absent: propodeum having whole upper surface very finely reticulate, though the reticulation extremely weakly raised on anterior parts of lateral areas, the plicae laterales in almost hinder half produced into a strongly raised crest which overhangs the spiracular area, the circular spiracles almost as far from fore as from hind margin of propodeum: apical segment of all tarsi (Text-fig. 13) greatly swollen, about equal in length to that of the three preceding segments combined, that of the fore tarsus the most swollen **occipitalis** sp. n. (p. 156)

– Not as above: head much more, generally very strongly, narrowed behind eyes: occipital carina almost always sharp and complete above, extending well below upper level of eye, though in one species distinct only behind the lateral ocelli: propodeum having upper surface mainly smooth and shining between the plicae laterales, which are well developed but not produced into a strongly raised crest, the, usually oval, spiracles much nearer fore than hind margin of propodeum; apical tarsal segments not thus swollen . . . . . . . . . . 2

2 Frontovertex with reticulation strong or moderately strong almost throughout and more or less regular . . . . . . . . . . . . . . 3

– Frontovertex with reticulation not strong or moderately strong, but either fine and regular or in greater part weak to indistinct . . . . . . . . 11

3 Sculpture of scutellum nearly uniform, either reticulate or striate almost throughout 4

– Sculpture of scutellum not nearly uniform, partly striate or striate-reticulate and partly reticulate, often partly smooth . . . . . . . . . 9

4 Sculpture of scutellum in greatest part and of mesoscutum similar, reticulate almost throughout . . . . . . . . . . . . . 5

– Sculpture of scutellum longitudinally striate almost throughout, except in the next species (couplet 7) very dissimilar from that of mesoscutum . . . 7

5 Carinae from lateral ocelli to orbital margin well developed: scutellum having a shining hind margin projecting backward over a large part of the metascutellum: propodeum having submedian carinae quite distinctly divergent from base: gaster beyond petiole broad-oval, about one-fifth longer than its greatest breadth: hind tibial spur extending slightly beyond apex of the relatively short metatarsus, the tibiae not pale at apex . . . . . . . ***inexpectatus*** sp. n. (p. 157)

– Carinae from lateral ocelli to orbital margin not or not distinctly developed: scutellum regularly rounded behind and not covering a large part of the metascutellum: propodeum having submedian carinae subparallel about half way back then diverging at about 45° (Waterston, 1915, fig. 13): gaster beyond petiole of more usual proportion, about one-half longer than its greatest breadth or more: hind tibial spur short and almost straight, not reaching far beyond mid length of corresponding metatarsus, the mid and hind tibiae pale at apex 6

6 Larger species, of length over 2 mm: petiolar segment strongly transverse, about twice as broad as long: antennal scape elongate and narrow for the genus, about seven times length of its greatest breadth, and almost reaching the median ocellus. Iran . . . . . . . . ***illustris*** (Waterston) (p. 158)

– Smaller species, of length about 1½ mm: petiolar segment a little longer than broad: antennal scape of more normal proportions, about four times length of its greatest breadth, not nearly reaching the median ocellus. Europe to southerly India ***acantha*** (Walker) (p. 159)

7 Wing fringe exceptionally long for the genus, the cilia at anal angle about a quarter, the seta at junction of marginal and radial veins a third, the greatest breadth of fore wing: setae exceptionally long and strong for the genus, the largest head seta, which arises just before the occipital margin, nearly the length of an eye, seen from above, the scutellar seta well over half the length of fore wing: sculpture of mesoscutum and scutellum in greatest part similar, coarsely longitudinally striate almost throughout, though that on scutellum merging to reticulate near apex: antennal scape and tibiae blue-green. New Hebrides ***longisetosus*** sp. n. (p. 160)

– Wing fringe very much shorter than as above, normal for the genus or shorter: setae not so very long and strong (as e.g. in Plate figures and Text-figs 10–15): sculpture of mesoscutum and scutellum dissimilar: antennal scape and tibiae stramineous, with no more than slight darkening near base of hind tibia . . 8

8 Lower face and clypeus smooth: antennal funicle in side view having first segment about one and a half times length of its greatest breadth and third about quadrate: sides of pronotal collar very little narrowed: gaster beyond petiole moderately elongate and markedly pointed towards apex, the first large tergite a little less than half its length . . . . . . ***ptychomyiae*** (Ferrière) (p. 161)

– Lower face and clypeus very finely but distinctly reticulate: antennal funicle in side view having first segment a little longer than broad and third much broader than long: sides of pronotal collar strongly narrowed: gaster beyond petiole very broad-oval, rounded at apex except for the protruding ovipositor sheaths, the first large tergite almost two-thirds its length . . ***bethylicidus*** sp. n. (p. 162)

9 Head, seen from above, relatively broad, 2½ to 3 times breadth of its median length and frontovertex usually about 1½ times: first funicle segment, in side view, in well-developed specimens, about 2½ times as long as broad: scutellum longitudinally striate-reticulate, merging to regular reticulation in about apical third, the sculpture of almost uniform strength except that, narrowly in mid

line in basal part, it is finer yet very distinct: space between notaular pits very much narrower than a pit (Pl. 4, fig. 1)
**foveolatus** (Crawford) (= *epilachnae* (Rohwer)) (p. 163)

– Head not so broad, less than 2½ times breadth of its median length and frontovertex less than 1½ times: first funicle segment, in side view, about 1½ times as long as broad: scutellum strongly longitudinally striate at sides almost to apex, with reticulation at apex that is rather wide-meshed but much weaker, and may extend forward broadly in mid line or may be evanescent, leaving a shining median band in about basal two-thirds: space between notaular pits about as broad as a pit . . . . . . . . . . . . . . 10

10 Antennal funicle 3-segmented and pronotal collar sharply margined as is normal for the genus: mesoscutum having longitudinal striation on sides of mid lobe and on parapsides, its hind margin between the notaular pits raised and strongly emarginate: petiolar segment much broader than long: lower face, as normally in the genus, almost smooth: tibiae not or hardly pale at base and apex. India and Ceylon to New Guinea . . **elasmi** (Ashmead) (= *lividiscutum* (Gahan) (p. 166)

– Antennal funicle 4-segmented: the smooth pronotal collar clearly indicated by a change of sculpture but with no elevated margin: mesoscutum without longitudinal striation, its hind margin between the notaular pits very weakly emarginate: petiolar segment a little longer than broad: lower face very distinctly reticulate except narrowly in mid line: tibiae very distinctly pale at base and apex. Australia, India . . . . . . . . **agaristae** (Cameron) (p. 167)

11 Scutellum rather strongly convex: sculpture of mesoscutum and of scutellum rather similar, consisting of reticulation that is relatively strongly outstanding, that is in large part coarse and tends to be longitudinal (Pl. 5, fig. 1): female gaster (Text-figs 5–6) not, as in most species, gradually more or less pointed but of masculine form, relatively broad and, apart from the ovipositor sheaths, very broadly rounded at apex, having the first large tergite relatively large, and the epipleura almost or quite meeting midventrally for a considerable length . 12

– Scutellum of normal convexity for the genus or flatter: sculpture of mesoscutum and of scutellum dissimilar, no more than moderately outstanding and patterned otherwise: female gaster not as in alternate but of normal feminine form, gradually more or less pointed to apex . . . . . . . . . 13

12 Head, seen from above, very broad, 2¾ times breadth of its median length: notaular pits rather well-defined, sub-triangular: propodeum having submedian carinae not coalesced at base and diverging less gently: first large tergite with sculpture not or not very distinct and not extensive . . **aspidomorphae** (Girault) (p. 128)

– Head, seen from above, less broad, 2½ times breadth of its median length; notaular pits ill-defined but of moderate depth: propodeum having submedian carinae coalesced at base, diverging rectilinearly and very gently to before the nucha: first large tergite with sculpture distinct × 45 and more extensive than in alternate, distinct to about half way forward . . . **viridifrons** (Motschulsky) (p. 169)

13 Notauli almost transverse, meeting before the notaular pits, the fore part of the mesoscutum before them distinctly raised above the hinder part: notaular pits smooth, quadrangular, separated only by a median keel (Pl. 5, fig. 2) . . 14

– Notauli running normally for the genus, not meeting medially nor causing such discontinuity of level across the mesoscutum: notaular pits separated by an area usually of breadth at least comparable to that of one of them, though in one species about one-third the width of either but very decidedly more than just a keel . . . . . . . . . . . . . . . 15

14 Head, seen from above, less broad, 2·0 to 2·2 times breadth of its median length; with ocelli in a very acute triangle, the lateral separated by little more than their longer diameter; with a fine, incomplete median furrow running back from the median ocellus: eyes extending very far below toruli, the genal margin almost

transverse: fore part of mesoscutum comparatively coarsely reticulate, and notaular pits separated by a rather strong median keel that tapers from the front: propodeum having submedian carinae closely juxtaposed or coalesced in about basal half: first large tergite virtually smooth: cubital hair-row starting immediately beyond basalis: tibiae mainly dull stramineous, with some darkening above . . . . . . . . ***carinatiscutum*** (Girault) (p. 170)

– Head, seen from above, broader, 2·3 times breadth of its median length, with ocelli in a slightly acute triangle, the lateral separated by twice their longer diameter; with a fine median keel running from the median ocellus right back to the occipital carina: eyes extending less far below toruli, the genal margin not almost transverse: fore part of mesoscutum with comparatively fine, concentrically arranged striation, and notaular pits separated by a fine median keel: propodeum having submedian carinae not juxtaposed basally (Pl. 5. fig. 10): first large tergite having reticulation clearly visible × 45 on hinder part: cubital hair-row starting well beyond the large speculum postbasale: tibiae metallic blue-green, the mid and hind pale at apex . . . . . . . . . ***anomalus*** (Gahan) (p. 171)

15 Frontovertex, at least in greater part, with reticulation fine and regular: pronotal collar having sides strongly or rather strongly narrowed: scutellum having sculpture more or less uniform, very distinct throughout: basalis bare, and cubital hair-row starting beyond the speculum postbasale . . . . 16

– Frontovertex in greater part with reticulation weak and irregular to indistinct: pronotal collar having sides no more than moderately narrowed except in *painei* (Ferrière), see couplet 16 below: scutellum having a median band, percurrent or almost so, with sculpture more or less indistinct, sometimes this median band broad and shining: except in *painei* (Ferrière), basalis bearing hairs and cubital hair-row starting immediately beyond it . . . . . . . 18

16 Smaller species, of length about 1·3 mm: head, seen from above (Text-fig. 11) subglobose, not sharply narrowed behind eyes, with ocelli in a strongly acute triangle, and no fine keel running back from the lateral ocelli, the frontovertex not as broad as its median length: antennae having first funicle segment in side view about quadrate, the second and third very distinctly transverse: pronotal collar having fore and hind margins parallel: mesoscutum having hind margin weakly emarginate, the notaular pits shallow and ill-defined: scutellum finely longitudinally reticulate throughout: parasite in Mantid oothecae
***fraternus*** (Motschulsky) (p. 173)

– Larger species: head, seen from above, more transverse, sharply narrowed behind eyes, with ocelli in about a right-angled or slightly acute triangle, and a fine keel running back from the lateral ocelli, the frontovertex at least slightly broader than its median length: antennae having first funicle segment in side view about twice as long as broad, the second and third distinctly longer than broad: pronotal collar wider at sides than in middle, the fore and hind margins not parallel: scutellum strongly longitudinally striate, merging to reticulate behind . . 17

17 Head having a distinct, fine median keel running from the median ocellus right back to the occipital carina (Text-fig. 12): antennal scape about 7 times length of its greatest breadth: pronotal collar more deeply emarginate in middle third: mesoscutum having reticulation rather regular on mid lobe, the notaular pits separated by a space about equal to the distance from their inner margin to the outer margin of their bronzy longitudinal impression. Burma, Sumatra . ***soror*** sp. n. (p. 174)

– Head having a mere indication of a furrow running part way back from the median ocellus: antennal scape about 4 times length of its greatest breadth: pronotal collar evenly emarginate behind: mesoscutum striate-reticulate on mid lobe, the notaular pits separated by a space about one-third the width of either. Pakistan, India . . . . . . . . . ***stenochoreus*** sp. n. (p. 175)

18 Frontovertex relatively narrow, about 1½ times the dorsal breadth of an eye, with ocelli in a very decidedly acute triangle: eyes, in facial view, extending very distinctly below level of toruli and cheeks correspondingly strongly narrowed: pronotal collar strongly contracted and rounded at sides: notaular pits rather clear-cut, of moderate depth, almost quadrangular, smooth, bearing the main seta about one-quarter the way back from the front: propodeum having submedian carinae subparallel for more than half way back, then diverging at more than 45° **painei** (Ferrière) (p. 176)

– Frontovertex relatively broad, about twice the dorsal breadth of an eye, with ocelli in a very slightly acute triangle: eyes, in facial view, extending hardly below level of toruli and cheeks correspondingly narrowed normally for the genus: pronotal collar with sides no more than moderately narrowed: notaular pits ill-defined, shallow, rounded, sculptured much as the rest of the mesoscutum, and bearing the main seta about one-third the way from the back: propodeum having submedian carinae diverging from base at much less than 45°. (*imbreus* group) 19

19 Shining and brightly coloured: head moderately emarginate behind (Text-fig. 10): median band of scutellum broad: nucha of propodeum very weakly emarginate at apex: first large tergite brightly coloured in about basal two-thirds. West Malaysia, Java, Borneo, associated with *Erionota thrax* (Hesperiidae) **erionotae** sp. n. (p. 178)

– Dull and mostly dull coloured: head more or less shallowly emarginate behind: median band of scutellum of moderate breadth to narrow: nucha of propodeum moderately to rather deeply emarginate at apex: first large tergite seldom brightly coloured in more than basal half, usually in much less . . . . . 20

20 Occipital carina discontinuous, represented only by a short ridge developed behind each lateral ocellus: antennal scape very slender, almost parallel-sided for the greater part of its length, about eight times length of its greatest breadth: third funicle segment about quadrate. Europe south of the Carpathians, Saudi Arabia, Pakistan . . . . . **waterstonii** (Masi) (= *obtusiceps* Bouček) (p. 179)

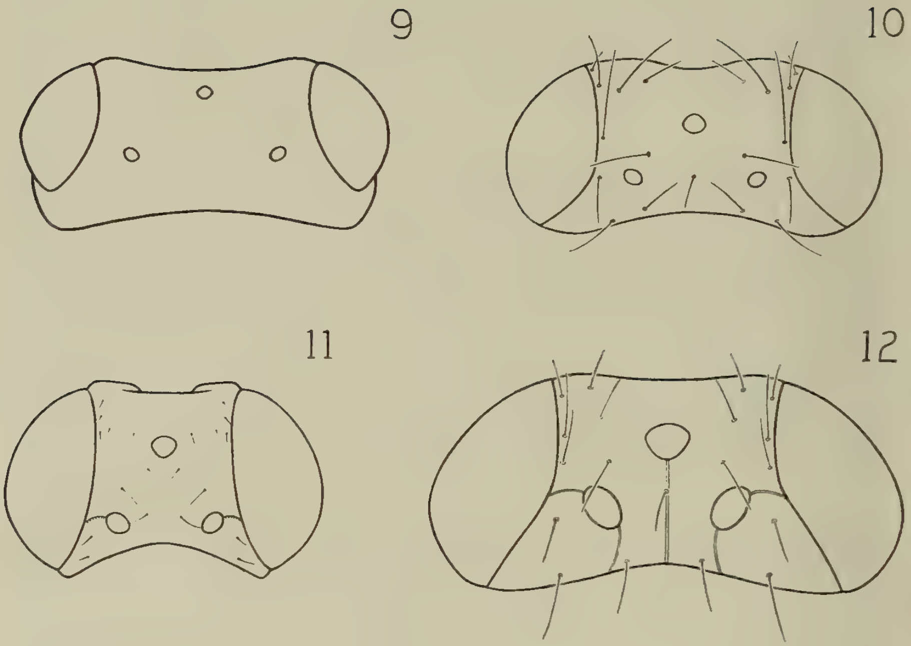
– Occipital carina continuous, as is normal in the genus: antennal scape slightly rounded below, no more than about five times length of its greatest breadth: third funicle segment distinctly broader than long . . . . . . 21

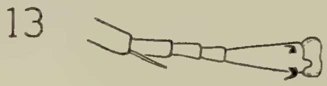
21 Head, seen from above, about three times breadth of its median length, very weakly emarginate behind, with ocelli in a slightly to moderately obtuse triangle: eyes distinctly hairy × 25: scutellum having median band narrow: nucha moderately emarginate at apex: hind tibial spur not reaching mid point of second tarsal segment. Australia . . . . . . . . **pieridis** sp. n. (p. 180)

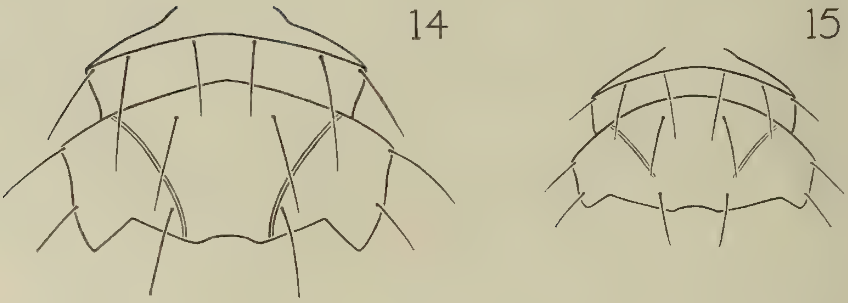
– Head, seen from above, about two and a half times breadth of its median length, rather weakly emarginate behind, with ocelli in a very slightly acute triangle: eyes distinctly hairy × 65: scutellum generally having median band moderately broad: nucha rather deeply emarginate at apex: hind tibial spur extending well beyond mid point of second tarsal segment. S.E. Asia . . . . . . 22

22 Sides of upper face moderately reticulate: sides of pronotal collar more contracted and mesoscutum more angulate (Text-fig. 14): antenna having first funicle segment very distinctly longer than broad (Ferrière, 1933, fig. 5b): gaster beyond petiole elongate-ovate, the fore wings not extending far beyond its apex **imbreus** Walker (= *detrimentosus* Gahan) (p. 181)

– Sides of upper face with reticulation weak and rather wide-meshed: sides of pronotal collar less contracted and of mesoscutum less angulate (Text-fig. 15): antenna having first funicle segment hardly longer than broad (Ferrière, 1933, fig. 5c): gaster beyond petiole ovate, i.e. relatively short, the fore wings extending further beyond its apex . . . . . . . **parvulus** (Ferrière) (p. 182)







Figs 9–12. Head, seen from above, of 9, *P. occipitalis* sp. n., 10, *P. erionotae* sp. n., 11, *P. fraternus* (Motschulsky) and 12, *P. soror* sp. n.

Fig. 13. *P. occipitalis* sp. n., left hind tarsus, plantar aspect.

Figs 14–15. Pronotum and mesoscutum of 14, *P. imbreus* Walker and 15, *P. parvulus* (Ferrière).

## ASIATIC SPECIES NOT STUDIED

### *Pediobius thoracicus* (Zehntner) comb. n.

*Pleurotropis thoracica* Zehntner, 1898 : 11–12, figs 14–18.

This species was described from Java, reared as a secondary parasite of *Cosmopteryx pallifasciella* Snellen (Cosmopterygidae) leaf-mining in sugar. According to information kindly supplied by Professor J. van der Vecht, the original material is almost certainly lost. The description and figures, based on the male sex only, suffice to place the species undoubtedly in *Pediobius* Walker. I do not find them good enough to place it in my key to the Asiatic species, but think they will be found sufficient to recognize the species with confidence when it has again been reared from the same primary host. I have requested that such rearings be made.

### *Pediobius ellia* (Motschulsky) comb. n.

*Tetrastichus Ellia* Motschulsky, 1863 : 69. LECTOTYPE ♂, CEYLON: 'des Montagnes de Nura-Ellia' (Zoological Museum of the University, Moscow), here designated [examined].

The material standing as this species is as follows: a mount on which are affixed a male *Pediobius* and an undetermined Pteromalid, bearing labels 'type' and 'Tetrastichus Ellia Motsch T. or. Ceyl. Mt. N.E.', and a second mount on which is affixed a female *Pediobius*, bearing a label 'Tetrastichus Ellia Motsch.' in manuscript and 'coll. Motschulskovo' in print. The first mount bears the further label 'Pediobius ellia (Motsch.) ♂ Zd. Bouček det. 1968'. Dr Bouček has not published any note following his examination of the material that year. Dr A. N. Zhelokhovtsev has kindly sent me the material on loan for study.

Dr Bouček and I are agreed that, for selection of lectotype, the Pteromalid can definitely be excluded. We are further agreed that, of the two *Pediobius*, the male fits the original description better in a number of points and should be designated as lectotype; in particular, the second large tergite is broader than the first in this specimen, and the extrusion of the genitalia presumably led the author to describe the abdomen as apically mucronate. The species belongs to the *imbreus* group. The frontovertex is bright blue-green and the mesoscutum brassy green, whereas in males of the other species of this group here treated, these parts are considerably darker.

The female specimen is also a species of the *imbreus* group: in my key to species it fits *pieridis* sp. n. much better than *imbreus*. It differs from *pieridis* most clearly as follows: first funicle segment about twice as long as broad, the third very distinctly longer than broad: pronotal collar not short: mesoscutum having sculpture weaker and hind margin hardly sinuate: scutellum having longitudinal striation much weaker: petiolar segment having longitudinal ridges rather strong and extending more than half way back: first large tergite blue-green in about basal half.

## NEOTROPICAL SPECIES

### *Pediobius irregularis* sp. n.

Head, seen from above, about twice breadth of its median length. Frontovertex having breadth about or less than its median length and one and a half times to twice the dorsal breadth of an eye, with ocelli in a strongly acute triangle, the lateral less than their longer diameter from orbital margin. Reticulation beside and behind lateral ocelli fine to very fine and weak, before this rather fine to moderately coarse and moderately outstanding, on triangle above frontal fork rather transverse, on upper face, lower face, clypeus and genae fine to very fine. Eyes extending below level of toruli, having pilosity very short and fine (× 100). Clypeus rather broad, its apical margin reflexed: mandibles elongate, but with teeth of normal length.

Antenna having scape about four times and pedicellus twice length of its greatest breadth: funicle slightly broadened in side view, the first segment about one and a half times length of its greatest breadth and third about quadrate or slightly broader than long, and club excluding terminal spine shorter than combined length of last two funicle segments.

Pronotal collar having sides moderately rounded. Notauli weakly but sharply impressed, leading to triangular notaular pits, which are rather shallow but very distinct and which bear the main seta about in or slightly forward of middle: mesoscutum having reticulation irregular, moderate to rather coarse on mid lobe, markedly less outstanding than on main part of frontovertex, on sides of parapsides weaker and finer and in the notaular pits much finer: hind margin broadly and weakly sinuate. Scutellum of triangular appearance, weakly convex, except near anterior margin coarsely, weakly and irregularly longitudinally striate to striate-reticulate, tending to be smooth near apex. Propodeum strongly raised to middle, having submedian carinae close together for their whole length, only slightly divergent from near base, often subparallel in about hinder half, and generally with an indication of a median carina: nucha short, markedly convex, deeply emarginate at apex: spiracles elongate-oval, hardly their longer diameter from margin of metanotum, the spiracular area, seen from above, produced into a weak rounded lobe above the hind coxa.

Petiolar segment almost one and a half times length of its basal breadth, rather finely elongate-reticulate, with anterior margin rather strongly raised. Remainder of gaster short-ovate, the first large tergite about half its length or little more, smooth, the following finely reticulate.

Hind tibial spur almost straight, reaching well beyond apex of metatarsus.

Frontovertex bright green through peacock-blue to red-violet: face and cheeks generally dull green to purplish-bronzy though occasionally brighter. Antennae having flagellum a more or less bright green: in most specimens scape and pedicellus stramineous to pale testaceous, the pedicellus with slight metallic darkening above, but in one these are metallic green also, so the other specimens may be slightly teneral. Dorsum of thorax and propodeum medium to dark green and red-violet: sides a duller green and bronzy. Gaster bronzy, the first large tergite medium green to red-violet except in middle of about apical quarter or sometimes much less. Coxae, hind trochanters and femora green to red-violet: tibiae and fore and mid femora very pale testaceous, with greater or lesser amount of metallic darkening, sometimes almost wholly darkened: tarsi stramineous, usually darkened only at extreme apex.

Holotype ♀. BRITISH HONDURAS: Melinda Road, 30.iii.1967, *ex* egg mass of *Exophthalmus vitticollis* Champion (Curculionidae) on citrus (*L. W. van Whervin*) (BMNH).

Paratypes. BRITISH HONDURAS: 11 ♀♀, same data as holotype but 21.iii.–10.iv.1967. Four males are present in the series.

Unlike any other species known to me, particularly in the form of the scutellum, which is of triangular appearance, weakly convex and having the sculpture mostly coarse but weakly raised. The propodeum is unusually strongly raised in middle.

Among African and Asiatic species it would run best with the parasites in Mantid oothecae, namely *modestus* (Masi) and *fraternus* (Motschulsky) respectively. It resembles these in the head shape, the comparatively short antennae and the weakly convex scutellum; but they differ from it markedly in having the sculpture of the mesoscutum and scutellum much finer and more regular, the scutellum not of triangular form but very broadly rounded behind, and the propodeum not markedly raised in middle.

In running this species in the keys of Bouček (1965) and Burks (1966) difficulty immediately arises in that the femora are mostly metallic but the tibiae pale. Ignoring that dichotomy, it is found to agree best with species secondarily parasitic in egg-sacs of spiders, namely *brachycerus* (Thomson) and *wilderi* (Howard) respectively. These two species are very similar, and merit comparison. They resemble *irregularis* sp. n. in having the propodeum rather strongly raised in middle, but differ in having the sculpture of the mesoscutum and scutellum much finer, the scutellum rather strongly convex, and the head, notably the frontovertex, broad, with the ocelli in a decidedly obtuse triangle.

The only other species known to me to be recorded from the neotropical region is *olethreutidis* (Gahan, 1932) from Cuba. Dr Burks confirms that this is closely related to *sexdentatus* (Girault) and would run with that in his key to the North American species.

## A VENATIONAL CHARACTER

Basalis bearing hairs, normally two, and cubital hair-row starting immediately beyond it (as in *P. glabratus* Bouček (Bouček, 1965, fig. 60)).

> *ropalidiae* (Risbec), *rhyssonotus* sp. n., *taylori* sp. n., *angustifrons* sp. n., *neavei* (Waterston), *acraconae* sp. n., *aspidomorphae* (Girault), *marjoriae* sp. n., *clinognathus* (Waterston), *arcuatus* sp. n., *homoeus* (Waterston), *praeveniens* sp. n., *hirtellus* (Masi), *furvum* (Gahan), *vignae* (Risbec), *afronigripes* nom. n., *vigintiquinque* Kerrich, *amaurocoelus* (Waterston), *dipterae* (Risbec), *occipitalis* sp. n., *inexpectatus* sp. n., *illustris* (Waterston), *acantha* (Walker), *longisetosus* sp. n., *ptychomyiae* (Ferrière), *bethylicidus* sp. n., *foveolatus* (Crawford), *elasmi* (Ashmead), *agaristae* (Cameron), *viridifrons* (Motschulsky), *carinatiscutum* (Girault), *erionotae* sp. n., *waterstonii* (Masi), *pieridis* sp. n., *imbreus* Walker, *parvulus* (Ferrière), *irregularis* sp. n.

Basalis bare, and cubital hair-row starting beyond the large speculum postbasale (as in *saulius* (Walker) (Bouček, 1965, fig. 24)).

> *setigerus* Kerrich, *coffeicola* (Ferrière), *anastati* (Crawford), *modestus* (Masi), *telenomi* (Crawford), *anomalus* (Gahan), *fraternus* (Motschulsky), *soror* sp. n., *stenochoreus* sp. n., *painei* (Ferrière).

The condition in *africanus* (Waterston) is described under that species (p. 144 above).

## HOST-PARASITE LIST

List of hosts and parasites of them mentioned in this work.

| Host | Parasite |
|---|---|
| ORTHOPTERA: MANTODEA | |
| Egg-cases of determined or undetermined mantids | *P. modestus* (Masi)<br>*P. fraternus* (Motschulsky) |
| HEMIPTERA | |
| *Antestiopsis orbitalis bechuana* Kirkaldy | *P. africanus* (Waterston) |
| *Antestiopsis* spp. | *P. africanus* (Waterston) |
| LEPIDOPTERA | |
| In many cases parasitism known to be or probably secondary | |
| *Acracona remipedalis* Karsch | *P. acraconae* sp. n. |
| *Agonoxena* sp. | *P. parvulus* (Ferrière) |
| *Anaphe infracta* Walsingham | *P. telenomi* (Crawford) |
| *Artona catoxantha* Hampson | *P. ptychomyiae* (Ferrière)<br>*P. elasmi* (Ashmead)<br>*P. imbreus* Walker |
| *Ascotis* sp. | *P. angustifrons* sp. n. |
| *Attacus atlas* L. | *P. elasmi* (Ashmead) |
| *Borbo impar* Mabille | *P. elasmi* (Ashmead) |
| *Busseola fusca* Hampson | *P. homoeus* (Waterston) |
| *Busseola* sp. or spp. | *P. furvum* (Gahan) |
| *Charaxes* sp. | *P. neavei* (Waterston) |
| *Chilo* sp. or spp. | *P. furvum* (Gahan) |
| *Cosmopteryx pallifasciella* Snellen | *P. thoracicus* (Zehntner) |
| *Cremotopsyche pendula* Joannis | *P. anomalus* (Gahan)<br>*P. imbreus* Walker |
| *Dasychira goodii* Holland | *P. arcuatus* sp.n. |
| ? *Dasychira* sp. | *P. angustifrons* sp. n. |
| *Dioryctria splendidella* Herrich-Schäffer | *P. occipitalis* sp. n. |
| *Epicephala chalybacma* Meyrick | *P. imbreus* Walker |
| *Erionota thrax* L. | *P. erionotae* sp. n. |
| *Lamprosema camphorae* Tams | *P. elasmi* (Ashmead) |
| *Laphygma exempta* Walker (see *Spodoptera*) | |
| *Leucoptera* spp. | *P. coffeicola* (Ferrière) |
| *Lithocolletis* sp. | *P. stenochoreus* sp. n. |
| Lymantriid indet. | *P. rhyssonotus* sp. n. |
| Lymantriid indet. (on cocoa) | *P. longisetosus* sp. n. |
| ? *Marasmia trapezalis* Guenée | *P. acantha* (Walker) |
| *Melanitis constantia* (Cramer) | *P. inexpectatus* sp. n. |

| Host | Parasite |
|---|---|
| *Metadrepana* sp. | *P. taylori* sp. n. |
| *Metisa plana* Walker | *P. elasmi* (Ashmead) |
| | *P. anomalus* (Gahan) |
| | *P. imbreus* Walker |
| *Mylothris* sp. | *P. taylori* sp. n. |
| *Nephantis serinopa* Meyrick | *P. imbreus* Walker |
| *Nephopteryx rhodobasalis* Hampson | *P. stenochoreus* sp. n. |
| *Odites* sp. | *P. angustifrons* sp. n. |
| *Ophioderes fullonia* (Clerck) | *P. agaristae* (Cameron) |
| *Pachypasa* sp. | *P. anastati* (Crawford) |
| *Pectinophora gossypiella* Saunders | *P. waterstonii* (Masi) |
| *Phalaenoides glycinae* Lewin | *P. agaristae* (Cameron) |
| | *P. pieridis* sp. n. |
| *Pieris rapae* L. | *P. pieridis* sp. n. |
| *Plutella xylostella* (L.) (= *maculipennis* (Curtis)) | *P. pieridis* sp. n. |
| *Proceras indicus* Kapur | *P. elasmi* (Ashmead) |
| *Pyrausta machaeralis* Walker | *P. soror* sp.n. |
| *Rhyacionia cristata* Walsingham | *P. occipitalis* sp. n. |
| *Sesamia* sp. or spp. | *P. furvum* (Gahan) |
| | *P. bethylicidus* sp. n. |
| *Spodoptera* (= *Laphygma*) *exempta* (Walker) | *P. afronigripes* nom. n. |
| | *P. amaurocoelus* (Waterston) |
| *Sylepta derogata* Fabricius | *P. amaurocoelus* (Waterston) |
| moth pupa on *Deguelia* | *P. soror* sp. n. |
| COLEOPTERA | |
| *Aspidomorpha* spp. (larvae or pupae) | *P. aspidomorphae* (Girault) |
| *Aspidomorpha* spp. (ova) | *P. praeveniens* sp. n. |
| *Coelaenomenodera elaidis* Maulik | *P. setigerus* Kerrich |
| | *P. coffeicola* (Ferrière) |
| | *P. vigintiquinque* Kerrich |
| | *P. parvulus* (Ferrière) |
| *Endelus bakeri* Kerremans | *P. anomalus* (Gahan) |
| *Epilachna* spp. and related genera | *P. foveolatus* (Crawford) |
| | *P. amaurocoelus* (Waterston) |
| *Exophthalmus vitticollis* Champion | *P. irregularis* sp. n. |
| *Promecotheca cummingii* Baly | *P. anomalus* (Gahan) |
| | *P. parvulus* (Ferrière) |
| *Promecotheca nuciferae* Maulik | *P. imbreus* Walker |
| *Promecotheca* sp. | *P. painei* (Ferrière) |
| | *P. parvulus* (Ferrière) |

| Host | Parasite |
|---|---|
| DIPTERA | |
| *Anacamptomyia bisetosa* Roubaud & Villeneuve | *P. ropalidiae* (Risbec) |
| *Melanagromyza vignalis* Spencer | *P. vignae* (Risbec) |
| *Phytomyza* sp. | *P. acanthae* (Walker) |
| *Sarcophaga* sp. | *P. elasmi* (Ashmead) |
| Tachinidae (various) | *P. ptychomyiae* (Ferrière) |
| Diptera indet. (in stem of millet) | *P. dipterae* (Risbec) |
| Diptera indet. (leaf-miner) | *P. acantha* (Walker) |
| Diptera indet. (in mines of *Amomum*) | *P. anomalus* (Gahan) |
| HYMENOPTERA-ACULEATA | |
| ? *Acantholepis* sp. | *P. marjoriae* sp. n. |
| *Belonogaster junceus* Fabricius | *P. ropalidiae* (Risbec) |
| *Belonogaster* sp. | *P. ropalidiae* (Risbec) |
| *Crematogaster* sp. (inquiline of) | *P. acraconae* sp. n. |
| *Polistes* sp. | *P. ropalidiae* (Risbec) |
| *Ropalidia guttatipennis* Saussure | *P. ropalidiae* (Risbec) |
| *Synagris cornuta* Fabricius | *P. clinognathus* (Waterston) |
| HYMENOPTERA-PARASITICA | |
| *Achrysocharis orientalis* (Ferrière) | *P. imbreus* Walker |
| *Apanteles* sp. or spp. | *P. angustifrons* sp. n. |
| | *P. neavei* (Waterston) |
| | *P. afronigripes* nom. n. |
| | *P. ptychomyiae* (Ferrière) |
| | *P. elasmi* (Ashmead) |
| | *P. erionotae* sp. n. |
| | *P. imbreus* Walker |
| *Anastatus* sp. | *P. anastati* (Crawford) |
| *Brachymeria* sp. | *P. neavei* (Waterston) |
| *Charops* sp. | *P. taylori* sp. n. |
| *Cotterellia podagrica* Waterston | *P. vigintiquinque* Kerrich |
| *Ecphoropsis* sp. | *P. amaurocoelus* (Waterston) |
| *Goniozus* sp. | *P. bethylicidus* sp. n. |
| *Gryon antestiae* (Dodd) | *P. africanus* (Waterston) |
| Microgasterine indet. | *P. carinatiscutum* (Girault) |
| *Parasierola nephantidis* Muesebeck | *P. imbreus* Walker |
| *Parasierola* sp. | *P. bethylicidus* sp. n. |
| | *P. imbreus* Walker |
| *Pediobius setigerus* Kerrich | *P. vigintiquinque* Kerrich |
| *Sympiesis kampalanus* (Ferrière) | *P. vigintiquinque* Kerrich |
| *Telenomus gowdei* Crawford | *P. telenomi* (Crawford) |
| *Trissolcus seychellensis* Kieffer | *P. africanus* (Waterston) |

| Host | Parasite |
|---|---|
| ARANEIDA | |
| Spider's egg-sac | *P. brachycerus* (Thomson)<br>*P. wilderi* (Howard) |
| Spider's egg-sac (supposed) | *P. carinatiscutum* (Girault) |

## ACKNOWLEDGEMENTS

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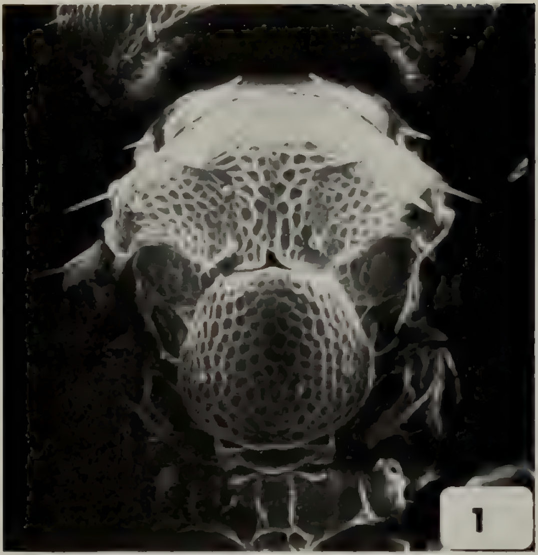
PLATE 1

Fig. 1. *P. ropalidiae* (Risbec), thorax × 145.

Fig. 2. *P. setigerus* Kerrich, thorax × 140.

G. J. Kerrich, M.A., D.Sc.
Commonwealth Institute of Entomology
c/o British Museum (Natural History)
London SW7 5BD
England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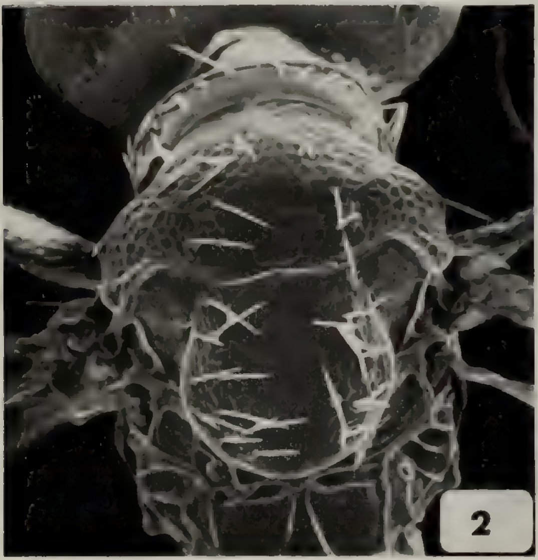
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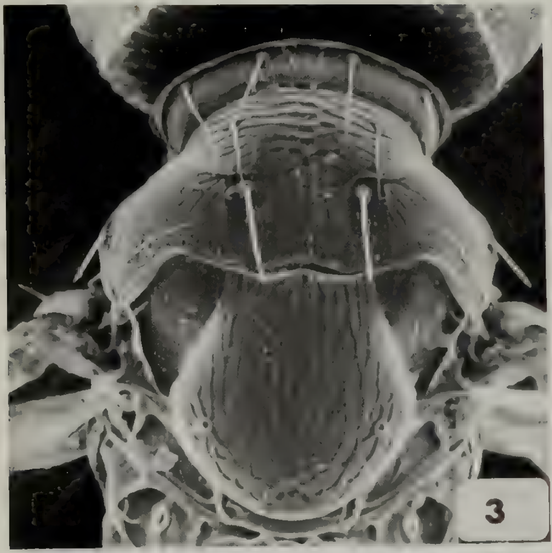
## PLATE 2

FIG. 3. *P. coffeicola* (Ferrière), thorax × 140.

FIG. 4. *P. clinognathus* (Waterston), thorax × 115.



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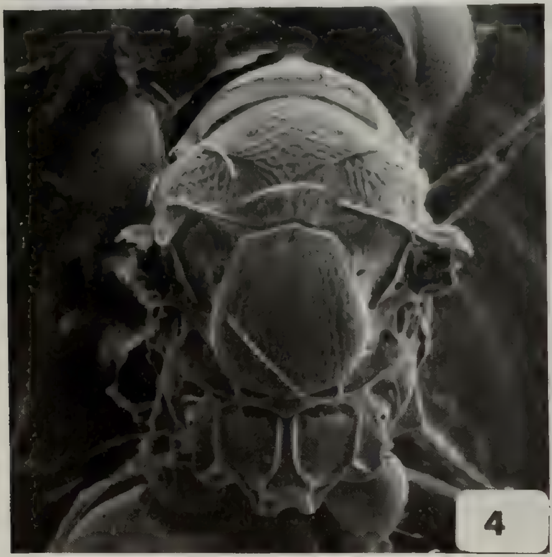
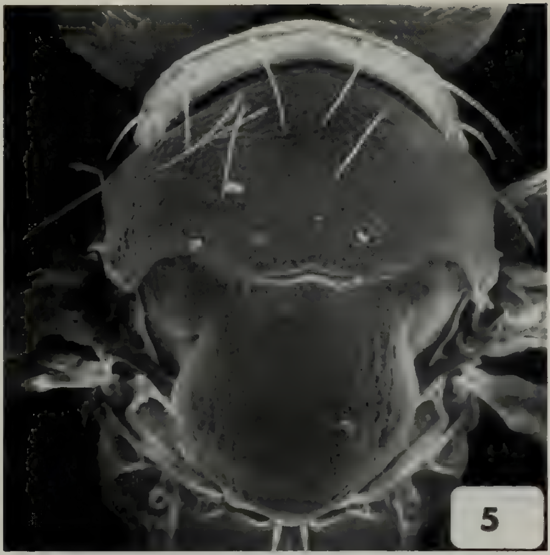


4

## PLATE 3

FIG. 5. *P. anastati* (Crawford), thorax × 145.

FIG. 6. *P. vigintiquinque* Kerrich, thorax × 140.



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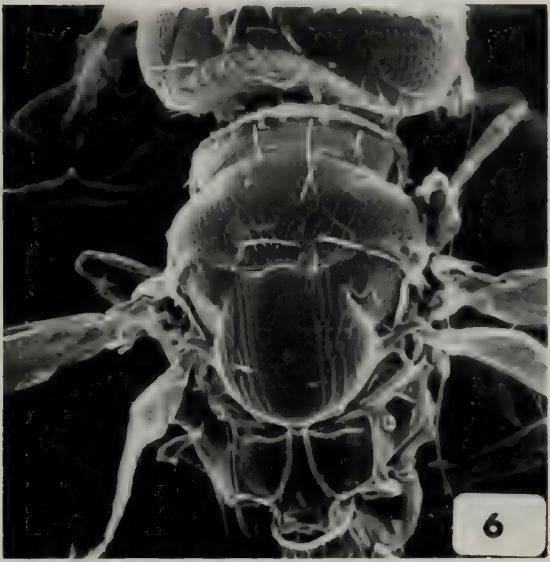

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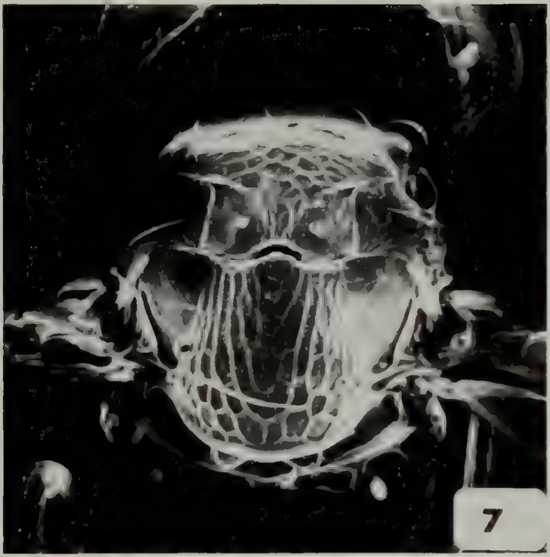
PLATE 4

FIG. 7. *P. foveolatus* (Crawford), thorax × 110.

FIG. 8. *P. elasmi* (Ashmead), thorax × 115.



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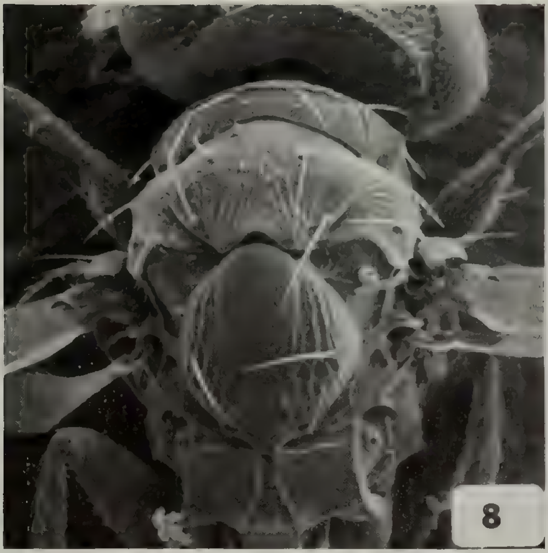

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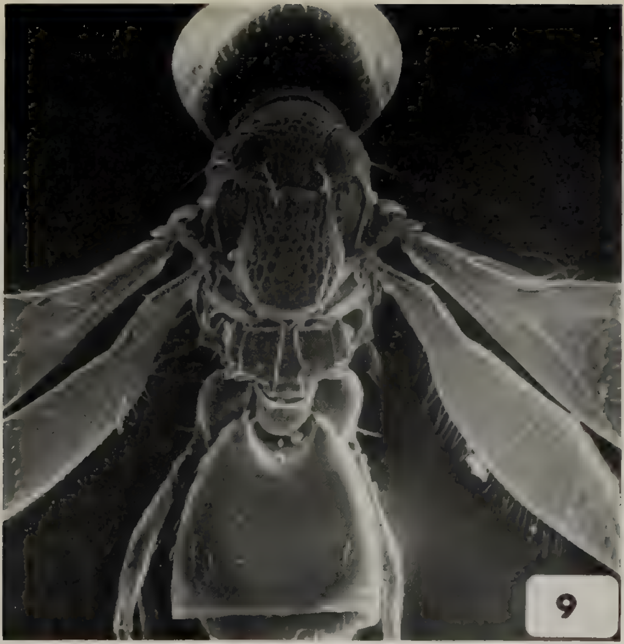
PLATE 5

FIG. 9. *P. aspidomorphae* (Girault), × 110.

FIG. 10. *P. anomalus* (Gahan), thorax × 110.



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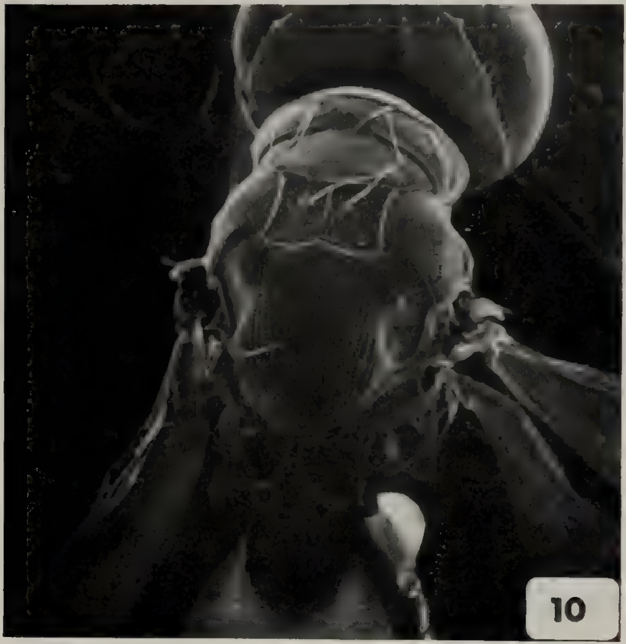

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BRITISH MUSEUM
12 DEC 1973
NAT HIST

T. CLAY

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*By* THERESA CLAY

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## SYNOPSIS

The *dispar* assemblage of species is defined with a key and four new species described. The species groups of *Pectinopygus* are defined with a key and the question discussed whether the *dispar* assemblage is a natural group equivalent to these other groups. The specialized setae found in *Pectinopygus* are described. The Piaget species of *Pectinopygus* are discussed, eight lectotypes designated and four names placed in synonymy.

## INTRODUCTION

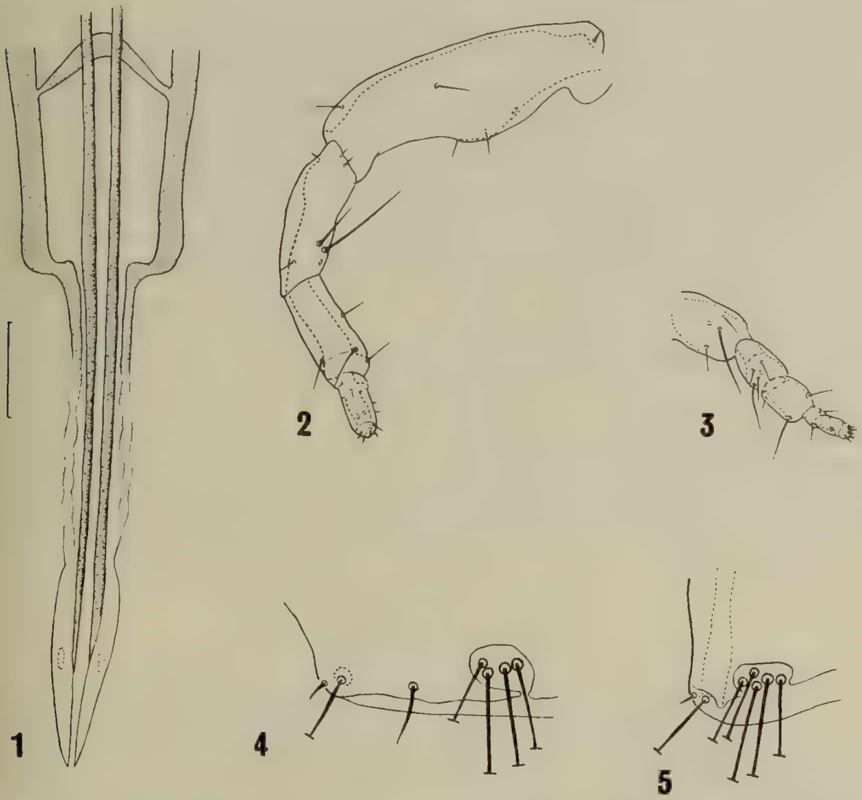
TIMMERMANN (1964, 1967) has discussed the species of *Pectinopygus* parasitic on 17 species included in the avian genus *Phalacrocorax* by Peters (1931) and arranged them in species groups. In 1967 he discussed, but did not describe, the species parasitic on *Phalacrocorax gaimardi*, pointing out that in the characters of the male genitalia it resembled the species found on those cormorants included by Peters in *Halietor*. Recently, through the kindness of Dr James E. Keirans, I received a series of a new species from *Phalacrocorax pelagicus:* this species, a new species from *P. penicillatus* and the species from *P. gaimardi* all have the same type of male genitalia. These, together with the species parasitic on the avian genus *Halietor* and the Old World species of *Anhinga*, are reviewed here as the *dispar* assemblage (hereafter called group). Whether in fact these are a natural group will also be considered. Synonymies, unless otherwise stated, are those given by Hopkins & Clay (1952); material, unless otherwise stated, is in the British Museum (Natural History).

## THE *DISPAR* GROUP

This group is distinguished from all other *Pectinopygus* by the characteristic male genitalia (Pl. 3, figs 18–19; Text-fig. 1), which differ interspecifically only in proportions and in the form of the cross-bar; there is no way of separating the females as a group. It comprises nine taxa having the following characters in common: antennal segment III without sexual dimorphism, segment I (scape) longer in the male, although in some species the difference between the sexes is slight; lens with ocular seta and temple with six setae each side, of which the fourth is always long, the remaining setae being short or spiniform, or of medium length or occasionally as long, or nearly as long as the fourth. The temple setal formula may show interspecific variation in the male but is similar throughout the group in the female, the ocular seta being spiniform and the temple setae usually short and spiniform (with the exception of the fourth) with the second and sixth sometimes longer. Pronotum with 2 + 2 marginal setae; pteronotum with postero-lateral group of five long setae each side (Text-fig. 5) with the occasional reduction in number on one side; trichobothrium and associated spiniform seta approximately level with marginal pteronotal setae, the spiniform seta being laterad to the trichobothrium. Mesosternum with two central setae, metasternum with 4, occasionally 5 or 6. In the male, abdominal tergites II–IV (that is the first three) and sternite II divided medially, sternum VIII varying interspecifically. Slightly mediad to the lateral edge of the abdomen there is an internal thickened buttress joining the dorsal and ventral surfaces, the junction of the buttress with the two surfaces producing the pattern characteristic of the species (Pl. 1, fig. 1). In mounted specimens there may be some individual variation in the shape of pattern due to slight distortion. As in other species of *Pectinopygus* the females may or may not have a central sclerite between the two widely divided tergal plates (Clay, 1955 : 171). In *P. dispar* and apparently in the other members of the group the vulval setae lie along the edge of the margin (Pl. 2, fig. 12), whereas in the rest of the *gyricornis* division the setae are submarginal, leaving a bare area below (Pl. 2, fig. 8), this area is greatly enlarged in the *turbinatus* group.

*Abdominal chaetotaxy*. Tergal setae, ♂: II–VIII, 2 central setae with 2 anterior on II and post-spiracular setae on VII and VIII. ♀: II–VI and VIII, 4 central setae with 2 anterior on II and post-spiracular on VII and VIII, number of central setae on VII varies. Sternal setae, ♂: II, VI, VII, 4 central setae; VIII, 2; other segments showing variation. ♀: II–VI, 4 central setae, VI with occasionally 1–2 extra setae; VII–VIII fused with 4 + 4. Pleural setae, ♂ and ♀: II, 0 + 0 (occasionally one on one side); III, 1 + 1 (occasionally 2 on one side); IV–V, 3 + 3; VI–VIII, 4 + 4 with 1 + 1 trichobothria on VIII. One of the lateral setae of IV–V and sometimes VI may be dorsal and rather similar in position to the 1 + 1 setae each side of VII and VIII here considered as the post-spiracular setae of those segments and not included in the count of the lateral setae. The post-spiracular setae are considered to be absent on segments IV–VI for the following reasons: (a) On segments II–V in the female there is a minute clear area in the usual position of the post-spiracular sensillum but without an adjacent seta, the dorso-lateral setae of IV and V not being associated with these areas. (b) This seta, which is sometimes latero-dorsal on VI, is more usually positioned as one of the four pleural setae also found on segments VII and VIII in addition to the post-spiracular setae of those segments. It seems in a number of Ischnoceran genera that segments VI—VIII each have the same number of pleural setae (excluding the trichobothrium) and that the actual number may prove to be a supraspecific character in some cases (Tandan & Clay, in preparation). (c) Second instar nymphs, in which the tergal and pleural plates on segments III–VIII are still separated or partially separated, have a seta each side lying approximately between these plates on VII–VIII and on VII well separated from other setae of the segment; these are assumed to be the post-spiracular setae of those segments. The lateral setae are either marginal or dorso- or ventro-lateral or just below the pleural plates and presumed to be pleural.

The chaetotaxy of the terminal segments of the male abdomen provides important taxonomic characters. In the *dispar* group, as well as in the larger



FIGS 1–5. 1, *Pectinopygus acutofasciatus*, distal part of male genitalia (line = 0.01 mm.). 2–3, Male antenna: 2, *Pectinopygus varius*; 3, *P. brevicornis*. 4–5, Pteronotal margin and setae (trichobothrium and associated spiniform seta and the five marginal setae): 4, *Pectinopygus forficulatus*; 5, *P. afer*.

*gyricornis* division, the usual pattern is a single antero-lateral dorsal seta each side and ventrally a central arrangement of setae comprising a group of usually three setae each side, one usually having a smaller alveolus; posterior and central to these setae is another group, their number, position and size giving the main specific differences (Text-fig. 6). There are nine lateral setae each side of the last segment, of which marginal 2 may lie well on the ventral surface in some species (Text-fig. 9, c); the outer of the three anal setae in some specimens may appear marginal, giving the appearance of a tenth marginal seta. Towards the anterior part of the segment there are in most of the species 1 + 1 setae (the outer (a) and inner (b) anterior setae, Text-fig. 9).

*The male genitalia.* There is considerable diversity in the form of these structures in the species belonging to the *gyricornis* division (p. 217) and it is not always possible to interpret and homologize the different parts. In the *gyricornis* group sclerotized parameres (the term as used in the Phthiraptera) articulating with the distal end of the basal apodeme appear to be absent, their function probably being taken over by paramere-like sclerites of the genital sac; there are other sclerites of the sac lying dorsal to the base of the basal apodeme (Timmermann, 1964, figs 2–3). In the *dispar* group (Text-fig. 1) in which there is a reduction of the sac and the sclerites, the appearance is different: there are two long thin sclerites lying dorsal to the basal apodeme, each passing posteriorly to the inner side of a blade-like structure; arising from each end of the basal apodeme is a thin irregular sclerite, which passes posteriorly to form the outer side of this blade-like structure. The small size and lack of sclerotization make it uncertain whether the formation of these structures has been correctly interpreted. The genitalia of *setosus* and *punctatus* (Timmerman, 1964, fig. 5), although appearing distinct, can be interpreted in the same manner as those of the *dispar* group. In the *gyroceras* group there is some connection between one of the paramere-like sclerites and the basal apodeme and in the *turbinatus* group (Timmermann, 1964, figs 6–7) true parameres seem to be present.

The *dispar* group can be further divided into three subgroups: the *afer* (including *dispar* but called *afer* to avoid confusion), the *acutofasciatus* and the *timmermanii.* The characters separating the first two subgroups and their included species are summarized below, the third, comprising three new species, is treated in more detail. Characters already given for the group are not repeated under the subgroups.

### The *afer* subgroup

Head with hyaline margin developed and faint temporal carinae posteriorly. Tergum II in both sexes with height (antero-posteriorly) compared to width relatively longer than in the *timmermanni* group (Pl. 1, figs 2, 4). In the male internal lateral abdominal thickening as in Pl. 1, figs 1, 2; sternite VIII divided medially; sterna IV–V with 2 central setae; marginal seta 2 of IX on margin. Female subgenital plate and chaetotaxy of sterna VII and VIII as in Text-fig. 12, but the outline of the plate shows some intraspecific variation; shape of last abdominal sternite as in Text-fig. 13; tergum VII with 2 central setae. Genital region laterally with two or more unmodified setae each side, modified setae with single elongated sclerite (Pl. 3, fig. 15 and see under Specialized Setae below); vulval setae on vulval margin. The species are not always distinguishable in the females, those of *dispar* vary in size (see below), the larger one with relatively large hypopharyngeal sclerites and a relatively broader anterior plate differ as much from the smaller ones of the same species as they do from smaller individuals of other species; the size and shape of the metasternal plates show intraspecific variation. Included species: *Pectinopygus dispar*, *P. afer*, *P. excornis* and *P. makundi*. Synonymy not given under the species is either given by Hopkins & Clay (1952) or on pp. 218 et seq.

## 1. ***Pectinopygus dispar*** (Piaget, 1880)

(Pl. 1, fig. 1; Pl. 2, fig. 7; Pl. 3, fig. 20; Text-fig. 6)

Type-host: '*Carbo sulcirostris*'. Error, probably *Halietor melanoleucos* (Vieillot).

The male is distinguished by having the characteristic lateral abdominal thickening on III as well as on IV–VIII (Pl. 1, fig. 1) and by the chaetotaxy of the terminal abdominal segment (Text-fig. 6). The cross-bar of the male genitalia is roof-shaped.

Dimensions (in mm). These are based on 18 males and 10 females taken from the localities listed below and parasitic on at least three subspecies of host. The rather larger range of certain measurements compared with those of some related species suggests that there may be a number of demes or local populations represented. However, there is insufficient material from most of the localities to make a statistical analysis. Head width: ♂ (18), 0·33–0·37, $\bar{X}$ 0·36, lectotype, 0·36; ♀ (10), 0·42–0·47, $\bar{X}$ 0·45, paratype, 0·45. Head length: ♂ (18), 0·45–0·52, $\bar{X}$ 0·49, lectotype, 0·50; ♀ (10), 0·50–0·54, $\bar{X}$ 0·52, paratype, 0·53. Head Index (C.I.): ♂, 0·71–0·74, $\bar{X}$ 0·73, lectotype, 0·72; ♀, 0·82–0·89, $\bar{X}$ 0·85, paratype, 0·85.

MATERIAL EXAMINED.

Holotype ♀ of *dispar:* syntypes 2 ♂, 3 ♀ of *subsetosus* (see below).

From *Halietor melanoleucos*. NEW ZEALAND: Otago, 2 ♂, 2 ♀, 27.ii.1950. TASMANIA: Green's Beach 1 ♂, 1 ♀, 23.x.1966 (*R. H. Green*); Fisher Island, 9 ♂, 1970 (*C. A. Nicholls*). AUSTRALIA: nr Perth, 6 ♂, 2 ♀, 1970 (*R. H. Stranger*). RENNELL IS.: Hatuana, 5 ♂, 4 ♀, 21.x.1953 and 3.iv.1965 (*T. Wolff*). NEW GUINEA: Skin (no locality), 7 ♂, 2 ♀; Moitaka, Papua, 1 ♂, 1 ♀, vii.1968 (*T. Wolff*).

## 2. ***Pectinopygus afer*** (Kellogg, 1910)

(Pl. 1, fig. 2; Pl. 3, figs 18–19; Text-figs 5, 7)

Type-host: *Halietor africanus africanus* (Gmelin)

This and the following two taxa resemble each other and differ from *dispar* in not having the characteristic male abdominal pattern on segment III. *P. afer* is distinguished by having the cross bar of the male genitalia centrally straight, not roof-shaped and in the arrangement of the ventral chaetotaxy of the terminal segment of the male abdomen (Text-fig. 7).

Dimensions. Head width: ♂ (11), 0·32–0·35, $\bar{X}$ 0·34; ♀ (10), 0·41–0·43, $\bar{X}$ 0·42. Head length: ♂, 0·46–0·48, $\bar{X}$ 0·47; ♀, 0·47–0·50, $\bar{X}$ 0·49. C.I.: ♂, 0·69–0·76, $\bar{X}$ 0·73; ♀, 0·85–0·89, $\bar{X}$ 0·87. Specimens measured taken from one host individual from S.W. Africa.

MATERIAL EXAMINED.

From *Halietor a. africanus*. Many males and females from ETHIOPIA, UGANDA, KENYA, BOTSWANA, SOUTH AFRICA, SOUTH WEST AFRICA.

### 3. ***Pectinopygus excornis excornis*** (Blagoveshtchensky, 1940)

(Text-fig. 8)

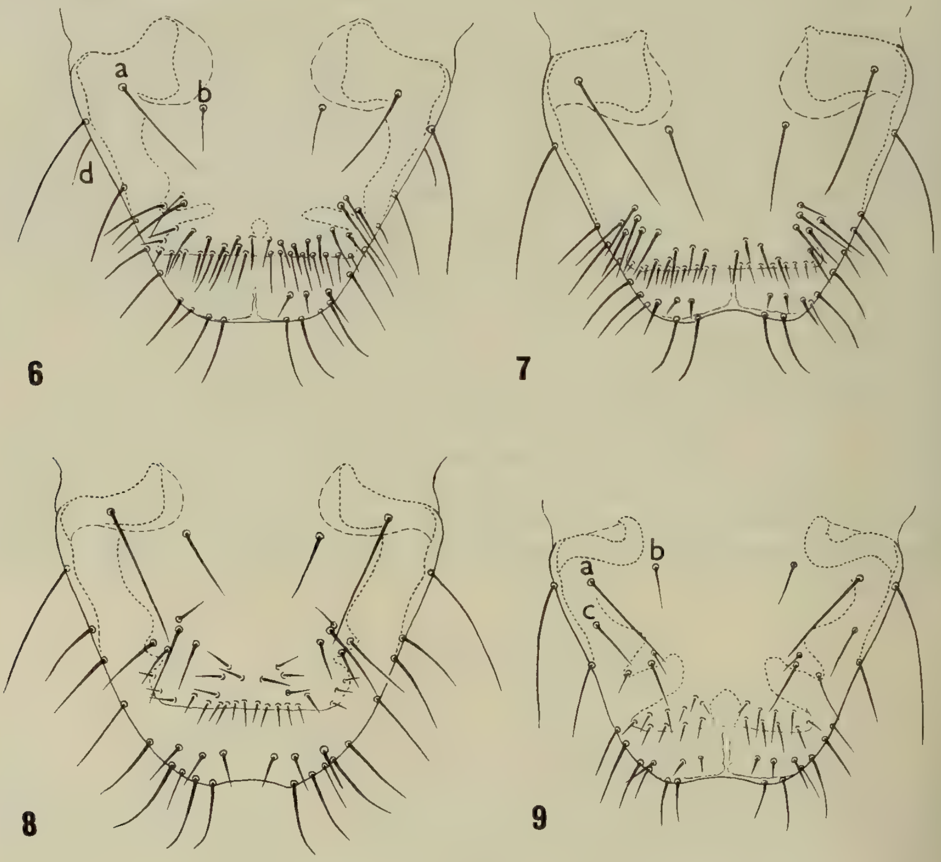
Type-host: *Halietor pygmeus* (Pallas)

The differences between this species and *afer* are given above under the latter species.

Dimensions (10). Head width: ♂, 0·33–0·35, X̄ 0·34; ♀, 0·42–0·44, X̄ 0·43. Head length: ♂, 0·44–0·46, X̄ 0·45; ♀, 0·47–0·49 X̄ 0·48. Head index: ♂, 0·74–0·77, X̄ 0·75; ♀, 0·89–0·92, X̄ 0·90.

MATERIAL EXAMINED.

From one individual of *Halietor pygmeus*. AFGHANISTAN: 31 ♂, 14 ♀, v.1937 (*R. Meinertzhagen*).



FIGS 6–9. Terminal sterna of male abdomen: 6, *Pectinopygus dispar* (anal setae omitted on left side); 7, *P. afer;* 8, *P. excornis;* 9, *P. acutofasciatus*. a, outer anterior seta; b, inner anterior seta; c, marginal seta 2; d, dorsal seta.

### 4. ***Pectinopygus excornis makundi*** Tandan, 1952 **comb. n.**

(Text-figs 12–13)

Type-host: *Halietor niger* (Vieillot)

*Pectinopygus makundi* Tandan, 1952 : 300.

In general appearance and proportions this species resembles *afer* (see Pl. 1, fig. 2) and is distinguished from *excornis* only by size and proportions of various parts of the body, of which the head and abdominal tergite II appear to be the most marked. However, except for the head it is not possible to make any detailed measurements of the available specimens of *excornis* owing to their poor condition. Any apparent difference in ventral chaetotaxy of the last segment of the male are covered by the slight variation in number, length and position of the setae found in the populations from the type-hosts. It would appear from this that it is more satisfactory to treat *makundi* as a subspecies of *excornis*.

Dimensions. Head width: ♂ (20), 0·32–0·34, X̄ 0·33, holotype, 0·33; ♀ (10), 0·40–0·43, X̄ 0·42; allotype, 0·42. Head length: ♂ (10), 0·47–0·49, X̄ 0·48; holotype, 0·49; ♀ (10), 0·48–0·51, X̄ 0·50; allotype, 0·49. Head index: ♂ (10), 0·67–0·70, X̄ 0·69; holotype, 0·68; ♀, 0·82–0·86, X̄ 0·84; allotype, 0·86.

MATERIAL EXAMINED.

Holotype ♂ from *Halietor niger*, INDIA: Lucknow, 4.x.1947 (*B. K. Tandan*).

From *Halietor niger*. Many males and females including allotype ♀ and paratypes from INDIA: Manipur, West Bengal, Utter Pradesh, Hyderabad (now Andhra Pradesh), Rajasthan. PAKISTAN: Sind.

### The *acutofasciatus* subgroup

This is similar to the *afer* subgroup except for a reduction in the size of the hyaline margin, the slight degree of sexual dimorphism of antennal segment I, the difference in the form of the lateral abdominal thickening of segments IV–VIII in the male (Pl. 1, fig. 6) and the shape of the last abdominal sternite in the female. In the male sterna IV–V each have 3–4 central setae, occasionally one of the segments with 2; marginal seta 2 of IX submarginal (Text-fig. 9). Female tergum VII with 4 central setae. Included species: *Pectinopygus acutofasciatus; P. aquaticus.*

### 5. ***Pectinopygus acutofasciatus*** (Piaget, 1880)

(Pl. 1, fig. 6; Pl. 3, fig. 15; Text-figs 1, 9, 14)

Type-host: *Anhinga melanogaster* Pennant

Posterior ventral setae of last segment of male as in Text-fig. 9: cross-bar of genitalia centrally roof-shaped. The female resembles those of the *afer* subgroup in having a number of lateral unmodified setae each side of the genital region and in the form of the modified setae (Pl. 3, fig. 15); one of the posterior of these setae each side is thick and spiniform. Shape of last female abdominal sternite as in Text-fig. 14.

Specimens have been seen from all the Old World species of *Anhinga* from the localities listed below. There are some differences in average size of specimens from some localities (see (a) and (b) below) but the ranges show that there is overlapping in all the cases. Concomitant with differences in size there may be some variation in the shape of the anterior plate, but here again this may show intra-population variation. No constant differences are apparent in specimens from *Anhinga melanocephala* and *A. rufa*, those from *A. novaehollandiae* are separable on the characters given below and are considered to merit taxonomic recognition.

Dimensions. Holotype ♀, head width: 0·43; head length: 0·50; C.I.: 0·85.

| Host | Head breadth | | Head length | | Head index | |
|---|---|---|---|---|---|---|
| | ♂ | ♀ | ♂ | ♀ | ♂ | ♀ |
| (a) | 0·37–0·40<br>$\bar{X}$ 0·39 (10) | 0·45–0·47<br>$\bar{X}$ 0·46 (8) | 0·48–0·51<br>$\bar{X}$ 0·49 (9) | 0·49–0·54<br>$\bar{X}$ 0·52 (8) | 0·77–0·81<br>$\bar{X}$ 0·80 | 0·85–0·94<br>$\bar{X}$ 0·88 |
| (b) | 0·35–0·37<br>$\bar{X}$ 0·36 (5) | 0·40–0·43<br>$\bar{X}$ 0·42 (8) | 0·46–0·48<br>$\bar{X}$ 0·47 (5) | 0·49–0·52<br>$\bar{X}$ 0·50 (8) | 0·75–0·79<br>$\bar{X}$ 0·77 | 0·82–0·85<br>$\bar{X}$ 0·83 |
| (c) | 0.36 (2) | 0·42–0·43 (3) | 0·47–0·48 (2) | 0·49–0·53 (3) | 0·76 | 0·84–0·85<br>$\bar{X}$ 0·85 |
| (d) | 0·36–0·39<br>$\bar{X}$ 0·37 | 0·43–0·45<br>$\bar{X}$ 0·44 | 0·46–0·50<br>$\bar{X}$ 0·48 (4) | 0·52–0·55<br>$\bar{X}$ 0·53 (4) | 0·76–0·78<br>$\bar{X}$ 0·77 | |
| (e) | 0·38–0·39 | | 0·49–0·51 (2) | | 0·77–0·78 | |
| (f) | 0·34–0·36 | 0·41–0·42 | 0·44–0·48 (2) | 0·49–0·50 (2) | 0·75–0·76 | 0·83–0·84 |

MATERIAL EXAMINED.

Holotype ♀ of *acutofasciatus* (see below).

From *Anhinga melanogaster* Pennant. INDIA: Lucknow (a), 10 ♂, 8 ♀ (*B. K. Tandan*); N. W. India (no further data), 1 ♀; Hyderabad (now Andhra Pradesh), 2 ♀, ii.1937 (*R. Meinertzhagen*); Rajasthan (b), 5 ♂, 8 ♀ iii.1937 (*R. Meinertzhagen*). BURMA (c): Shingbwiyang, N. E. Burma, 2 ♂, 3 ♀, 27.x.1945 (*H. S. Fuller*).

From *Anhinga r. rufa* (Daudin). SUDAN (f): 2 ♂, 2 ♀, v.1936 (*R. Meinertzhagen*). UGANDA (e): 2 ♂ , bird skin, vii.1906 (*R. Meinertzhagen*). KENYA (d): 1♂, 3 ♀, iv.1936 (no other data); Kisumu, 3 ♂, 1 ♀, ii.1956 (*R. Meinertzhagen*).

## 6. ***Pectinopygus aquaticus* sp. n.**

Type-host: *Anhinga novaehollandiae* (Gould)

This species is at once separable from *acutofasciatus* in the male by the form of the cross-bar of the genitalia, which is similar to that of *afer*, being flattened and not roof-shaped. It also differs in having temple setae 1–3 of the male longer than in *acutofasciatus*. There are difficulties in using the length of the long setae as a taxonomic character in the Phthiraptera, owing to the fine tips frequently being broken, and further the setae often do not lie in the same plane and seldom in a straight line. It is not therefore possible to give a series of comparative measurements of the temple setae of the specimens from various hosts. The comparison of approximate measurements and of specimens show that there is some variation in the specimens from *A. melanogaster* and that the first seta tends to be shorter in specimens from *A. rufa*. Although the length of some of the setae of specimens from *A. melanogaster* may overlap with those from *novaehollandiae*, seta 3 seems to be consistently longer in the specimens from the latter host. It would not be satisfactory to erect the new species on this character alone, but it is associated with the constant difference in the form of the cross-bar of the male genitalia.

Dimensions. Head width: ♂ (5), 0·37–0·40, X̄ 0·39; ♀ (3), 0·45–0·47, X̄ 0·46. Head length: ♂, 0·48–0·51, X̄ 0·49; ♀ (3), 0·53 0·54, X̄ 0·538. Head index: ♂, 0·76–0·79, X̄ 0·77; ♀, 0·85–0·88, X̄ 0·86.

MATERIAL EXAMINED.

Holotype ♂ from *Anhinga novaehollandiae* (skin). AUSTRALIA: New South Wales (*Meinertzhagen*). BMNH (slide No. 4392).

Paratypes. 4 ♂, 3 ♀ with data as for holotype.

## The *timmermanni* subgroup

Head without definite hyaline margin. Tergum II in both sexes with height to width relatively shorter than in the *afer* subgroup (Pl. 1, figs 3, 2). Male with internal lateral thickening of segments IV–VIII similar to that of *afer* group but differing in detail; sterna IV–V with 2 central setae; sternum IX with marginal seta 2 submarginal (Text-fig. 10). The female differs from the preceding subgroups and resembles the remaining species in Table I in having only one unmodified seta each side of the genital region and in having some of the modified setae with two internal sclerites (see below, p. 218; Pl. 3, fig. 16). The species of this subgroup resemble those of the *turbinatus* group in the absence of a hyaline margin and in *P. insularis* there is a superficial resemblance in the shape of the head and anterior plate, especially in the female. However, in the male the antenna, internal abdominal thickening and genitalia separate the two groups and in the female of the *turbinatus* group the inner ends of the internal sclerites of the modified setae bend inwards towards each other meeting in a small area and that part of the vulva below the setae is enlarged.

### 7. ***Pectinopygus timmermanni*** **sp. n.**

(Pl. 1, fig. 3; Pl. 3, fig. 17; Text-fig. 10)

Type-host: *Phalacrocorax gaimardi* (Lesson)

This species is distinguished from the two following by the shape of the anterior plate; in the male by the chaetotaxy of the last segment and in the female by the chaetotaxy of tergum VII.

♂. Characters as shown in Pl. 1, fig. 3 and as given under the *dispar* group and the *timmermanni* subgroup. First temple seta of medium length, not long as in the following species. Ventral chaetotaxy of terminal segment as in Text-fig. 10, marginal seta 2 submarginal.

♀. Characters as given for the *dispar* group and *timmermanni* subgroup. Tergum VII with 2–3 central setae (1 + 2–3 + 1); sternum VI with 6 (rarely 4 or 5) central setae. One of the modified setae each side of the genital region is stout and spiniform; chaetotaxy of this region as in Pl. 3, fig. 17.

Dimensions. Head width: ♂ (10), 0·32–0·34, X̄ 0·33; ♀ (7) 0·38–0·40, X̄ 0·39. Head length: ♂, 0·41–0·43, X̄ 0·42; ♀, 0·45–0·47, X̄ 0·46. Head index: ♂, 0·78–0·81, X̄ 0·79; ♀, 0·85–0·88, X̄ 0·86.

MATERIAL EXAMINED.

Holotype ♂ from *Phalacrocorax gaimardi* (skin). PERU: coast, viii.1875 (BMNH, slide No. 754).

Paratypes. 9 ♂, 7 ♀ with data as for holotype.

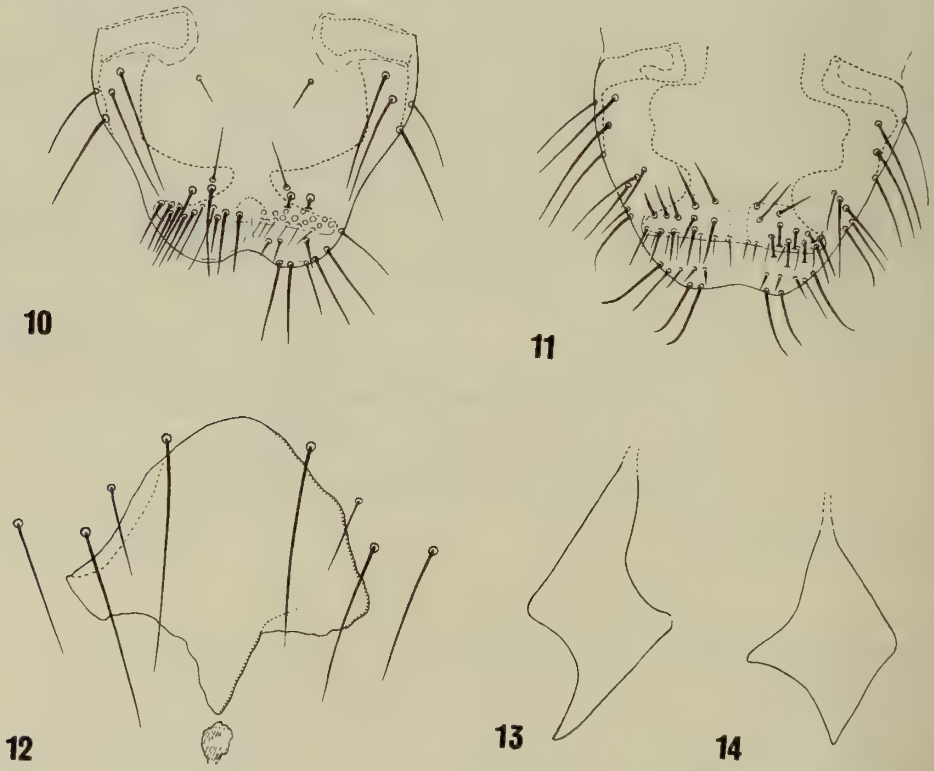
### 8. ***Pectinopygus maritimus*** **sp. n.**

(Pl. 1, fig. 5; Text-fig. 11)

Type-host: *Phalacrocorax penicillatus* (Brandt)

♂ and ♀. Characters as shown in Pl. 1, fig. 5 and as given for the *dispar* group and *timmermanni* subgroup; differences from *timmermanni* and *insularis* as given under those species. In the male the first temple seta is long; ventral chaetotaxy of last segment as in Text-fig. 11, marginal seta 2 submarginal, inner anterior seta absent. In the female tergum VII with 4 central setae (1 + 4 + 1); chaetotaxy of genital region as in Pl. 2, fig. 11.

Dimensions. Head width: ♂ (9), 0·32–0·34, X̄ 0·33; ♀ (10), 0·38–0·40 X̄ 0·39. Head length: ♂, 0·39–0·42, X̄ 0·41; ♀, 0·44–0·46, X̄ 0·45. Head index: 0·79–0·83, X̄ 0·81; ♀, 0·84–0·89, X̄ 0·87.



FIGS 10–14. 10–11, Terminal sterna of male abdomen: 10, *Pectinopygus timmermanni* sp. n. (marginal setae 4–9 and anal setae omitted on left side); 11, *P. maritimus* sp. n. 12, Female genital plate, *Pectinopygus e. makundi*. 13–14, Female terminal sternite: 13. *P. e. makundi;* 14, *P. acutofasciatus*.

MATERIAL EXAMINED.

Holotype ♂ from *Phalacrocorax penicillatus.* U.S.A.: San Diego, California, 3.iii.1939 (*Clay*) (BMNH, slide No. 12883a).

Paratypes. 8 ♂, 17 ♀ with data as for holotype.

### 9. ***Pectinopygus insularis* sp. n.**

(Pl. 1, fig. 4, Pl. 2, figs 11–12; Pl. 3, fig. 16)

Type-host: *Phalacrocorax pelagicus resplendens* Audubon

♂ and ♀. Characters as given for *maritimus* above; the two species are separable on the proportions of the head (see dimensions below and Pl. 1, fig. 4).

Dimensions. Head width: ♂ (10), 0·34–0·37, $\bar{X}$ 0·36; ♀ (10), 0·42–0·47, $\bar{X}$ 0·44. Head length: ♂, 0·41–0·43, $\bar{X}$ 0·42; ♀, 0·45–0·50, $\bar{X}$ 0·48. Head index: ♂, 0·84–0·88, $\bar{X}$ 0·86; ♀, 0·91–0·96, $\bar{X}$ 0·93.

MATERIAL EXAMINED

Holotype ♂ from *Phalacrocorax pelagicus resplendens.* U.S.A.: Oregon, Curry County 7.ix.1969 (*Easton*) (USNM Washington).

Paratypes. 14 ♂, 17 ♀ with data as for holotype.

Note on host. The specimens on which this species is based were collected from unidentified nestling cormorants. However, as shown in Clifford *et al.* (1970 : 442) there is no doubt that these were *P. pelagicus*, it being possible to eliminate other possible cormorants nesting in that area by a comparison of the species of *Pectinopygus* known to parasitize them.

### KEY TO THE SPECIES OF THE *DISPAR* GROUP

Males

| | | | |
|---|---|---|---|
| 1 | | Internal abdominal thickening of V as in Pl. 1, fig. 6 | 2 |
| | – | Internal abdominal thickening of V as in Pl. 1, figs 2–3 | 3 |
| 2 | (1) | Cross-bar of genitalia centrally roof-shaped (Text-fig. 1) | ***acutofasciatus*** (p. 209) |
| | – | Cross-bar of genitalia centrally flattened | ***aquaticus*** (p. 210) |
| 3 | (1) | Anterior margin of head with hyaline area; ratio of height to width of segment II as in Pl. 1, fig. 2 | 4 |
| | – | Anterior margin of head without hyaline area; ratio of height to width of segment II as in Pl. 1, fig. 4 | 7 |
| 4 | (3) | Abdominal segment III with characteristic pattern of thickening | ***dispar*** (p. 207) |
| | – | Abdominal segment III without characteristic pattern of thickening | 5 |
| 5 | (4) | Cross-bar of genitalia centrally flattened | ***afer*** (p. 207) |
| | – | Cross-bar of genitalia centrally roof-shaped | 6 |
| 6 | (5) | Head Index: 0·74–0·77, $\bar{X}$ 0·75 | ***e. excornis*** (p. 208) |
| | – | Head Index: 0·67–0·70, $\bar{X}$ 0·69 | ***e. makundi*** (p. 209) |
| 7 | (3) | Inner anterior seta of sternum IX present | ***timmermanni*** (p. 211) |
| | – | Inner anterior seta of sternum IX absent | 8 |
| 8 | (7) | Head Index: 0·79–0·83, $\bar{X}$ 0·81 (Pl. 1, fig. 5) | ***maritimus*** (p. 212) |
| | – | Head Index: 0·84–0·88, $\bar{X}$ 0·86 (Pl. 1, fig. 4) | ***insularis*** (p. 213) |

Females

1 More than one unmodified seta each side of genital region; modified setae with one elongate internal sclerite (Pl. 3, fig. 15) . . . . . . 2
– One unmodified seta each side of genital region; some modified setae with two elongate internal sclerites (Pl. 3, fig. 16) . . . . . . . 3
2 (1) Tergum VII with 4 central setae . . . . **acutofasciatus** subgroup (p. 209)
– Tergum VII with 2 (occasionally 3) central setae . . . . **afer** subgroup (p. 207)
3 (1) Tergum VII with 2–3 central setae . . . . . **timmermanni** (p. 211)
– Tergum VII with 4 central setae . . . . . . . . . 4
4 (3) Head Index: 0·84–0·89, $\bar{X}$ 0·87; shape of anterior plate as in ♂ (Pl. 1, fig. 5) . . . . . . . . . . . . **maritimus** (p. 212)
– Head Index: 0·91–0·96, $\bar{X}$ 0·93; shape of anterior plate as in ♂ (Pl. 1, fig. 4) **insularis** (p. 213)

## THE SPECIES GROUPS OF *PECTINOPYGUS*

*Pectinopygus* is separated from the rest of the Philopteridae by a combination of the following characters: the form of the anterior carinae of the head (Pl. 1); the anterior plate which usually has an anterior striated region, but never crescentic markings (as in *Ardeicola*) and is never divided medianly by a narrow vertical suture (as in *Fulicoffula*); the fourth temple seta is always long. Pronotum without anterior central setae (present in *Ardeicola*); mesonotum without central setae (present in *Philoceanus* complex). Female with row or rows of long inwardly directed setae each side of the last sternum and at least two of the female anal setae sheathed; male genital opening terminal or ventro-terminal.

Harrison (1937 : 31; see Thompson, 1935) recognized four subgenera parasitic respectively on the Pelecanidae (*Epipelecanus*, *Pectinopygus forficulatus*), *Morus* (*Pectinopygus*, *P. bassani*), Fregatidae (*Eprifregata*, *P. gracilicornis*) and Phalacrocoracidae (*Philichthyophaga*, *P. gyricornis*). The species from *Sula* were placed in the subgenus *Pectinopygus* although the description was based solely on *Pectinopygus bassani* and does not apply to the species parasitic on *Sula*. These are rather a distinct group, resembling the species from the Fregatidae in the presence of two discrete projections each side of the posterior margin of the terminal segment of the female, but not fitting satisfactorily into any of the subgenera as now constituted. The species of *Pectinopygus* can be arranged in a number of species groups (see key below) but it does not seem useful to give them subgeneric names.

One of the objects of this communication is to consider whether the *dispar* group is a natural one comparable with other groups within the *gyricornis* division (see 5 and the following couplets in Key p. 217). For this comparison 11 characters have been scored for 25 species of the *gyricornis* division parasitic on *Phalacrocorax*, *Halietor* and *Anhinga*. Where a number of species have all 11 characters in the same state they are placed together and given a number, 12 such groups emerge from this study (Table I). A number of other characters could be included, but they merely reinforce the present grouping and do not add any useful information.

Considering first the members of the *dispar* group (9–12 below the line in Table I) it will be seen that the males resemble each other and differ from other species

## Table I

### CHARACTER STATES

| Species or Species groups | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | a | c | a | + | b | + | + | c | + | + | + |
| 2 | a | c | a | + | a | + | + | b | + | + | + |
| 3 | a | c | a | o | c | + | + | b | + | + | + |
| 4 | a | c | a | + | b | + | + | g | + | + | + |
| 5 | a | b | b | + | b | + | + | f | + | + | + |
| 6 | o | c | c | + | c | o | + | d | + | + | o |
| 7 | o | b | d | o | c | + | o | h | + | + | + |
| 8 | o | a | e | + | a | + | + | e | + | o | + |
| 9 | o | a | b | + | a–b | + | + | a | o | o | + |
| 10 | a | a | b | + | a | + | + | a | o | o | o |
| 11 | b | a | b | + | a | + | o | a | + | o | o |
| 12 | b | a | b | + | c | + | o | a | + | o | + |

### KEY TO TABLE 1

SPECIES: 1. *gyricornis* group (*gyricornis*, *varius* Timmermann, 1964, *kosswigi* Timmermann, 1964, *socotranus* Timmermann, 1964). 2 *punctatus* Timmermann, 1964. 3. *setosus*. 4. *acutifrons*. 5. *brevicornis*. 6. *gyroceras* group (*gyroceras*, *faralloni*, *nannopteri*). 7. *turbinatus* group (*turbinatus*, *carunculatus* Timmermann, 1964, *magellanicus* Timmermann, 1967, *grubeni* Timmermann, 1967). 8. *anhingae*. 9. *acutofasciatus* group (*acutofasciatus*, *aquaticus* sp. n.). 10. *afer* group (*afer*, *dispar*, *excornis*, *makundi* Tandan, 1952). 11. *timmermanni* sp. n. 12. *maritimus* group (*maritimus* sp. n., *insularis* sp. n.).

CHARACTER STATES (Character present: + ; character absent or different: o). 1. ♂ abdominal pattern: a. as in Pl. 1, fig. 2; b. as in Pl. 1, fig. 3. 2. Scape: a. little or no sexual dimorphism; b. enlarged and swollen (Text-fig. 3); c. enlarged with anterior margin convex medianly (Text-fig. 2). 3. ♂ tergites divided medianly: a. only II–III; b. only II–IV; c. only II–V. d. only II–VI; e. only II–VII. 4. ♂ ocular seta short to medium. 5. ♂ temple setae: a. only 4th long; b. one or more of medium length; c. 4th and one or more long. 6. II with o + o, III with 1 + 1 pleural setae. 7. Head with hyaline margin. 8. a–g distinct types of male genitalia. 9. ♀ with one unmodified seta each side of genital region (Pl. 3, fig. 17). 10. Vulval setae submarginal (Pl. 2, fig. 8): +; vulval setae marginal (Pl. 2, fig. 12): o. 11. ♀ tergum VII with 4 central setae.

(with the exception of those given in brackets) in the characters of the genitalia, form of the antenna (except *anhingae*) and the number of divided tergal plates (except *brevicornis*): and the female in the position of the vulval setae (except *anhingae*). The male abdominal thickening is of three types, that of the *afer* group being the same as that of groups 1–5. However, the characters of both sexes in which they differ from each other seem to be important. The three New World species (*timmermanni*, *maritimus* and *insularis* differ from the Old World species (*acutofasciatus* and *afer* subgroups) in a character of the female chaetotaxy (No. 9, Table I), the form of the modified setae and in the absence of a definite hyaline margin of the head. In considering groups 1–8 (above the line in Table I), by definition the groups containing a number of species (1, 6, 7) are those in which all the character states, including those of the male genitalia, are the same; group 5 represented by a single species which, differing from group 1 in the form of the genitalia, also differs from the latter in other characters; *punctatus* Timmermann and *setosus* with a rather similar type of male genitalia differing from those of group 1, and *acutifrons* with distinct genitalia otherwise fit into this group except for the lengths of some of the head setae in *setosus* and *acutifrons*. The *dispar* group is the only one in which there is great similarity in the form of the genitalia associated with differences in other characters and cannot therefore be considered as equivalent to such groups as 1, 6, and 7. It seems unlikely, if it were not for the similarity of the genitalia, that groups 10 and 11–12 would be considered together. The genitalia, which may be a simplified form of those found in other groups, could be a primitive type which has persisted in certain species or species groups, their presence not necessarily implying relationships; the simple form of the antenna may also be primitive.

It seems reasonable to consider the *afer* subgroup as a natural assemblage of species: they are all parasitic on the avian genus *Halietor*, are similar in characters 1–11 and the females are separable from those of all others in the *gyricornis* division, with the exception of the *acutofasciatus* group, by the characters of the ventral chaetotaxy of the terminal segments. It is possible that the characters shared by the *acutofasciatus* and *afer* subgroups, if not denoting relationships, are persistent primitive ones, or alternatively the *acutofasciatus* group is derived from an old established straggling population originating from a species of the Old World avian genus *Halietor*, with or without hybridization. There is no particular resemblance between the species on the New and Old World *Anhinga*, except for the absence of sexually dimorphic antennae and in character 10 of the female; this suggests either a different origin for the two species groups or a long period of separation and divergence. Again, the more distant resemblance between the *timmermanni* and *afer* subgroups suggests a different origin for the two. Alternatively, *Phalacrocorax pelagicus*, breeding as it does on both sides of the Bering Strait, might have at one time overlapped in distribution with one of the Old World *Halietor* or the stock giving rise to these, and acquired a population of lice which was subsequently transferred to other west coast North American cormorants. The possibility of any relationships between these hosts is a subject which must be left to the ornithologists. The many characters separating the *turbinatus* and *timmermanni* groups show that these are not closely related in spite of the superficial resemblance of one of the species of the latter group to *turbinatus*.

## KEY TO GROUPS IN *PECTINOPYGUS*

1 Posterior margin of pteronotum with lateral group of 3–6 long setae and one separate seta (in addition to trichobothrium and associated spiniform seta, Text-fig. 4); abdominal segment II with 2 + 2 and III with 3 + 3 lateral (pleural) setae . . . . . . . ***forficulatus*** division

– Posterior margin of pteronotum with lateral group of 5 long setae (occasionally 3–6 on one side only) and no separate seta (Text-fig. 5); lateral setae of II and III otherwise . . . . . . . . . . . . . 2

2 (1) Pronotum with 1 + 1 marginal setae (outer spiniform seta absent) . . . . . . . . . . . . . ***sulae*** division
– Pronotum with 2 + 2 marginal setae . . . . . . . . 3
3 (2) Dorsal anterior plate with small postero-lateral projection each side . ***bassani***
– Dorsal anterior plate without such projections . . . . . . . . 4
4 (3) ♂ abdominal segment IV markedly shorter than III or V; ♀ terminal segment ending in two discrete projections each side; vulva without postero-lateral setae-bearing projection each end . . . . . ***crenatus*** division
– ♂ abdominal segment IV not markedly shorter than III or V; ♀ terminal segment without two discrete projections each side; vulva with postero-lateral setae-bearing projection each end (Pl. 2, fig. 8) ***gyricornis*** division 5
5 (4) Abdominal segment II with 1 + 1 and III with 2 + 2 pleural setae . . . . . . . . . . . . ***gyroceras*** group
– Abdominal segment II with 0 + 0 and III with 1 + 1 pleural setae . . 6

From here onwards males only are considered as the females do not fall into well-defined groups except for the *afer* and *turbinatus* group, discussed elsewhere.

6 (5) Male genitalia as in Pl. 3, figs 18–19, and Text-fig. 1 . . . ***dispar*** group (see p. 213)
– Male genitalia otherwise . . . . . . . . . . . 7
7 (6) Lateral abdominal pattern of thickening as in Pl. 1, fig. 2 . . . . . 8
– Pattern of thickening otherwise . . . . . . . . . 12
8 (7) Tergite IV interrupted medianly . . . . . . . ***brevicornis***
– Tergite IV not interrupted medianly . . . . . . . . . 9
9 (8) Ocular seta long . . . . . . . . . . ***setosus***
– Ocular seta short . . . . . . . . . . . . 10
10 (9) Genitalia with paramere-like structures stout and at least one toothed (Timmermann, 1964, figs 2–3 . . . . . . . . ***gyricornis*** group
– Genitalia otherwise . . . . . . . . . . . 11
11 (10) Terminal segment with 1 + 1 outer anterior setae . . . . ***punctatus***
Terminal segment with 4–6 outer anterior setae each side . . . ***acutifrons***
12 (7) Antennal segment III sexually dimorphic . . . . ***turbinatus*** group
– Antennal segment III not sexually dimorphic . . . . . ***anhingae***

## SPECIALIZED SETAE IN *PECTINOPYGUS*

Two types of setae are found in *Pectinopygus* which have not been seen elsewhere in the Ischnocera; these are:

*Sheathed setae.* These setae under this name were first shown by Harrison (1937 : 32) to be present in *Pectinopygus*. In the female of all species and in the males of some, at least two of the anal setae have their basal portion covered by an extension of the integument; the alveolus of these setae, apparent in the body setae of most Ischnocera, is here hidden (Pl. 3, fig. 20). Elsewhere (Clay, 1972) setae in which the alveolus is covered occurring on the female genital region of *Rallicola* have been discussed. However, in appearance and form they are quite distinct from the sheathed anal setae of *Pectinopygus*, which appear to be a diagnostic for the females of this genus. Using the SEM a minute sense peg can be seen close to the middle anal seta in the females of *Pectinopygus dispar* and *varius* (Pl. 3, figs 13–14). In specimens in good condition this can be seen with the light microscope, but with this microscope only it is not possible to say with certainty whether these pegs are present in all *Pectinopygus* or in other Ischnocera.

*Modified genital setae.* These setae are found in the female of the species comprising the *gyricornis* division (couplet 5 onwards in the key to Species Groups). They arise ventrally each side from a raised part of the last segment, the surface of this being ribbed (Pl. 2, fig. 9); this ribbing is not easily seen with transmitted light. The SEM shows that the bases of these setae are internal and with the light microscope it appears that they are extended inwards as a narrow sclerite of various lengths giving a characteristic and unique appearance to this part of the abdomen. In the *afer* and *acutofasciatus* subgroups there is only a single internal sclerite (Pl. 3, fig. 15), while in the remaining subgroups of the *dispar* assemblage and in the rest of the *gyricornis* division some of the setae have a second sclerite, sometimes set at an angle, at the end of the first sclerite (Pl. 3, figs 16–17). Those species in which there is only a single internal sclerite have two or more unmodified setae laterad to the rows of modified setae each side (Pl. 3, fig. 15); those with the double sclerites have only one seta each side (Pl. 3, fig. 17). Sections show the proximal sclerite having a wide lumen and the distal one being virtually solid. In addition to the setae with the elongate sclerite, some of the vulval setae have a short elongation of the base (Pl. 3, fig. 17), a condition also found in the lateral setae of the female genital region of *Colilipeurus* (see Clay, 1956, fig. 25).

## SYNONYMY OF PIAGET'S SPECIES OF *PECTINOPYGUS*

The synonymy of most of the Piaget species of *Pectinopygus* as presently accepted was given by Hopkins & Clay (1952) without explanation. The opportunity is now taken to explain the interpretation of some of the names and hosts and to designate lectotypes from the Piaget collection in the British Museum (Natural History). The specimens now in the Riksmuseum van Natuurlijke Historie, Leiden (RNH) have also been examined. Elsewhere (Clay, 1949), an account of the Piaget collection has been given and it was shown that most of the specimens were collected from skins in the Leiden Museum or from animals in the Rotterdam Zoological Gardens, and that there are many stragglers and erroneous host records. There are also obvious cases of mislabelling or omission of the specific name. A cause of confusion is what appears to be the labelling of specimens with an earlier specific name which were later described by Piaget as a new species, but without alteration being made to the original labels. Thus, these specimens have the correct type-host and agree with Piaget's figure and description but do not have the new specific name. In such cases, where the specimens can be identified, the designation of one as lectotype seems to be justified.

### ***Pectinopygus acutofasciatus*** (Piaget)

*Nirmus acutofasciatus* Piaget, 1880 : 172. Holotype ♀ (slide No. 1018, BMNH) from *Plotus melanogaster* = *Anhinga melanogaster* Pennant, Java.
*Pectinopygus acutofasciatus* (Piaget) Hopkins & Clay, 1952 : 267.

The holotype female has more than one unmodified seta laterad to the modified genital setae and there is only the single internal sclerite arising from the base of the modified setae (Pl. 3, fig. 15). This places it either in the *acutofasciatus* or *afer* subgroup and the presence of four central setae on tergum VII shows that it belongs to the former and is the species described above under this name.

### ***Pectinopygus annulatus*** (Piaget)

*Lipeurus annulatus* Piaget, 1880 : 340. LECTOTYPE ♂ (slide No. 944, BMNH), here designated, from *Sula fusca* = *Sula leucogaster* (Boddaert), no locality.
*Pectinopygus annulatus* (Piaget); Hopkins & Clay, 1952 : 268.

There are no slides in the Piaget collections labelled *Lipeurus annulatus* and this is apparently one of those cases mentioned above, in which Piaget labelled the specimen with an earlier name and forgot to add his new name to the slide when he later described it as new. There are a number of specimens of *Pectinopygus* in the Piaget collection labelled *Lipeurus pullatus* (a synonym of *bassani*) from various species of *Sula;* these agree with Piaget's figure of that species with the exception of a male and female. The host of the male is given as *Sula fusca* (= *S. leucogaster*) and the specimen agrees with Piaget's figure of *annulatus* and with authenticated specimens from *Sula leucogaster.* There seems little doubt that the figure of *annulatus* was based on this specimen and it is here designated as lectotype.

### ***Pectinopygus bifasciatus*** (Piaget)

*Lipeurus bifasciatus* Piaget, 1880 : 342. Lectotype ♂ (BMNH); paralectotypes 5 ♂, 1 ♀ (BMNH, RNH) from *Pelecanus crispus* Bruch, no locality.
*Pectinopygus bifasciatus* (Piaget); Hopkins & Clay, 1952 : 268.
*Pectinopygus bifasciatus* (Piaget); Clay, 1961 : 56, fig. 17.

The terminal segments of the male abdomen were figured and a lectotype designated by Clay (1961).

### ***Pectinopygus dispar*** (Piaget)

*Nirmus dispar* Piaget, 1880 : 174. Lectotype ♀ (slide No. 1014) and 1 ♀ paralectotype (BMNH), here designated, from *Carbo sulcirostris* = *Phalacrocorax sulcirostris* (Brandt), no locality.
*Lipeurus subsetosus* Piaget, 1880 : 336. LECTOTYPE ♂ (slide No. 928, BMNH) and 1 ♂, 3 ♀ paralectotypes (1 ♀ in BMNH; 1 ♂, 2 ♀ in RNH), here designated, from '*Phalacrocorax* (*Graculus*) *melanotus*', no locality. **Syn. n.**
*Lipeurus brevicornis* Piaget, 1880 : 337 nec *brevicornis* Denny, 1842. LECTOTYPE ♂ (slide No. 799) and 6 ♂ paralectotypes (BMNH), here designated, from *Carbo sulcirostris* = *Phalacrocorax sulcirostris terretori* (Mathews), CELEBES. **Syn. n.**
*Lipeurus confusus* Bagnall & Hall, 1912 : 9. Replacement name for *brevicornis* Piaget. **Syn. n.**
*Pectinopygus brevicornis* (Piaget); Hopkins & Clay, 1952 : 268.
*Pectinopygus confusus* (Bagnall & Hall); Hopkins & Clay, 1952 : 268.
*Pectinopygus dispar* (Piaget); Hopkins & Clay, 1952 : 268.
*Pectinopygus subsetosus* (Piaget); Hopkins & Clay, 1952 : 270.

Although the syntypes of *dispar* are females, making exact identification difficult, there is no doubt that they agree with specimens of the *afer* group in the ventral chaetotaxy of the terminal segments, which is specific to this group; the presence of two central setae on tergum VII separate them from *acutofasciatus*. Measurements are not necessarily specific for individuals of the *afer* group, but those of the female head breadth, length and head index average more in specimens from the type-host of *subsetosus* than for those of the rest of the *afer* group. These measurements in the *dispar* type material fall within the range of the former specimens, the *dispar* and *subsetosus* paratypes having the same measurements. Further, among specimens in the Piaget collection labelled as from *Carbo sulcirostris*, the type-host of *dispar*, are identifiable males of *setosus* and *subsetosus* and it is reasonable to suppose that the two female *dispar* are the same as one of these species; if this is so they could only be *subsetosus*. The latter name, therefore, becomes a synonym of *dispar*. The true host was probably *Halietor melanoleucos* (see under *P. subsetosus* below).

The name given by Piaget to the type-host of *subsetosus* does not apply to any known bird. *Halietor melanoleucos melvillensis* (Mathews) was formerly known as *Phalacrocorax melanurus* and there are two skins so labelled in the Leiden Museum which Piaget could have examined. Authenticated specimens from *Halietor melanoleucos* are the same as Piaget's type material and it can be assumed that this species is the type-host of *subsetosus*, Piaget probably having misread the label on the skin. As already shown, the name becomes a synonym of *dispar*. There is also a male *setosus* on the same slide as the lectotype, a further indication of the mixing of the specimens from this group of hosts.

There are three slides in the Piaget collection (BMNH) labelled *brevicornis* with the host name and locality as given in the original description. The seven males on these slides are *Pectinopygus dispar* and do not entirely agree with Piaget's figure and description of *brevicornis*. These are rather confusing: the figure of the antenna shows one of a type similar to that of *P. longicornis* on the same plate and rather similar to that of *setosus* except that the second segment is somewhat longer; in the description Piaget states that the antenna is shorter than those of other species (presumably *setosus* and *brevisignatus*) and gives the length of the male antenna as nearer that of the length given for *subsetosus* than for *setosus*. It is obvious that the figure and the description are not based on the antenna of the same species. In the description of *brevicornis* the first three abdominal segments are said to have a median suture which agrees with the tergal divisions in *dispar* (= *subsetosus*); the dimensions are said to be similar to those of *setosus* which broadly covers those of *dispar*.

It must be presumed that the description of *brevicornis* is taken from more than one species and is not entirely accurate even for these. Piaget had a number of specimens labelled with the host name *Carbo sulcirostris* which he described under three different names (*dispar*, *setosus* and *brevicornis*) and which represent two species, *setosus* and *dispar*. Hopkins & Clay (1952) sank *brevicornis* as a synonym of *setosus* as the figure of the antenna seemed to be more like that of *setosus* than *dispar* and it was assumed that the type material was unrecognizably included among the specimens labelled *setosus*. However, as the description may be based partly on the specimens of *dispar* labelled with the specific name *brevicornis* and the given host and locality, the only slides from that host on which the locality is given, it seems more satisfactory to designate one of these specimens as lectotype and sink *brevicornis* as a synonym of *dispar*. The matter is of no great importance as the syntypes had no valid name until 1912 and *brevicornis* was already a later name than either *dispar* or *setosus*.

### ***Pectinopygus gracilicornis*** (Piaget)

*Lipeurus gracilicornis* Piaget, 1880 : 309. LECTOTYPE ♂ (slide No. 824) and 2 ♀ paralectotypes (BMNH), here designated, from *Fregeta minor*, no locality.
*Pectinopygus gracilicornis* (Piaget); Hopkins & Clay, 1952 : 269.

The lectotype is conspecific with authenticated males from *Fregeta m. minor* (Gmelin).

### ***Pectinopygus gyricornis*** (Denny)

*Lipeurus gyricornis* Denny, 1842 : 58.
*Lipeurus longicornis* Piaget, 1880 : 334. LECTOTYPE ♂ (slide No. 460, BMNH) and 2 ♂, 2 ♀ paralectotypes (1 ♀ in BMNH; 2 ♂, 1 ♀ in RNH), here designated, all from *Phalacrocorax carbo*, no locality.
*Pectinopygus longicornis* (Piaget); Hopkins & Clay, 1952 : 269.

Although Piaget recorded this species from both *Phalacrocorax carbo* and *P. aristotelis*, the species occurring on these two hosts are quite distinct. The lectotype is the species found on *Phalacrocorax carbo* and is the same as the male holotype of *P. gyricornis* in the Denny collection (BMNH).

### ***Pectinopygus setosus*** (Piaget)

*Lipeurus setosus* Piaget, 1880 : 335. LECTOTYPE ♂ (slide No. 498) and 3 ♂, 2 ♀ paralectotypes (BMNH), here designated, from *Phalacrocorax* (*Graculus*) *sulcirostris* = *Phalacrocorax sulcirostris* (Brandt), no locality.
*Lipeurus setosus* var. *brevisignatus* Piaget, 1880 : 336. LECTOTYPE ♂ (slide No. 501, BMNH) and 3 ♂, 4 ♀ paralectotypes (2 ♂, 2 ♀♀ in BMNH; 1 ♂, 2 ♀ in RNH), from *Carbo javanicus* = *Halietor niger* (Vieillot), no locality.
*Pectinopygus setosus* (Piaget); Hopkins & Clay, 1952 : 270.
*Pectinopygus brevisignatus* (Piaget); Hopkins & Clay, 1952 : 268.

The lectotype of *setosus* is conspecific with authenticated material from the type host.

No differences could be found between the lectotypes of *setosus* and *brevisignatus*, the differences given by Piaget not being apparent. Authenticated specimens from *Halietor niger*, the type-host of *brevisignatus*, are *P. excornis makundi* and quite distinct from the lectotype of the former species. It is probable that Piaget's specimens labelled *brevisignatus* originated from *Phalacrocorax sulcirostris*, confusion having arisen during collecting or labelling.

## ***Pectinopygus sulae*** (Rudow)

*Lipeurus sulae* Rudow, 1869 : 43. Neotype ♂ (slide no. 13438a, BMNH) from *Sula leucogaster plotus* Forster, Java.

*Lipeurus tuberculatus* Piaget, 1885 : 61. Holotype ♀ (slide No. 434, BMNH) from *Procellaria glacialis*, no locality. **Syn. n.**

*Pectinopygus tuberculatus* (Piaget): Hopkins & Clay, 1952 : 270.

The holotype female of *tuberculatus* belongs to the *sulae* division of species (see Key above) and does not appear to be separable from female 'neoparatypes' (see Clay & Hopkins, 1955 : 65) of *Pectinopygus sulae* (Rudow) from *Sula leucogaster plotus* Forster.

## ***Pectinopygus turbinatus*** (Piaget)

*Oncophorus turbinatus* Piaget, 1890 : 233. Holotype ♂ (slide No. 344, BMNH) from *Mycteria senegalensis* (error), no locality.

*Pectinopygus turbinatus* (Piaget); Hopkins & Clay, 1952 : 270.

*Pectinopygus macquariensis* Harrison, 1937; Timmermann, 1964 : 280.

The holotype is the same as authenticated material from *Phalacrocorax atriceps* King.

### ACKNOWLEDGEMENTS

I am indebted to Mr P. N. Lawrence and the staff of the Electron Microscope Unit (BMNH) for the SEM photographs and to the Photographic Studio for the photographs on Plate I. Also to Dr James E. Keirans and Dr K. C. Emerson for the loan of material.

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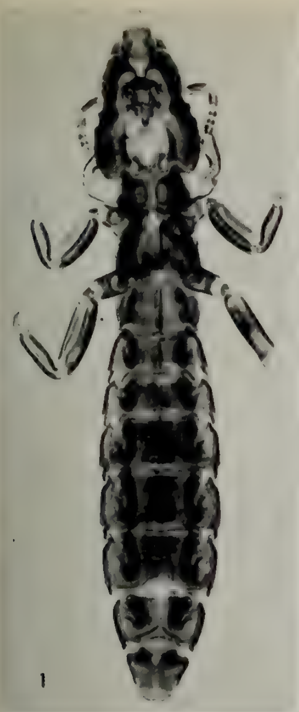
## PLATE I

Fig. 1. *Pectinopygus dispar* (Lectotype of *subsetosus*).
Fig. 2. *Pectinopygus afer.*
Fig. 3. *Pectinopygus timmermanni.*
Fig. 4. *Pectinopygus insularis.*
Fig. 5. *Pectinopygus maritimus.*
Fig. 6. *Pectinopygus acutofasciatus.*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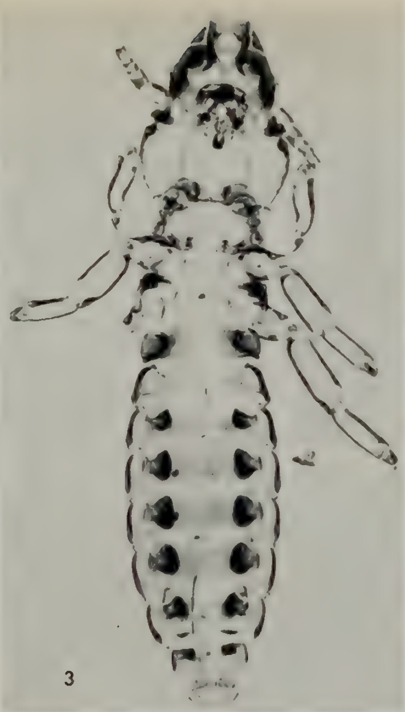
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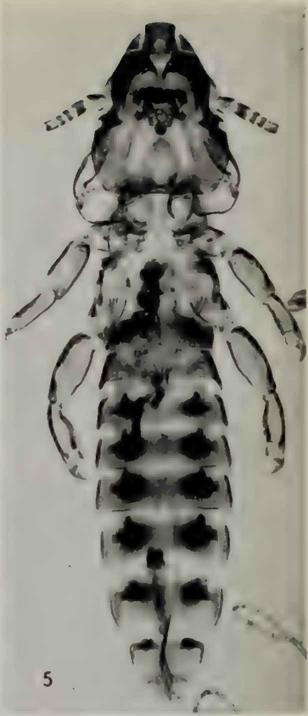
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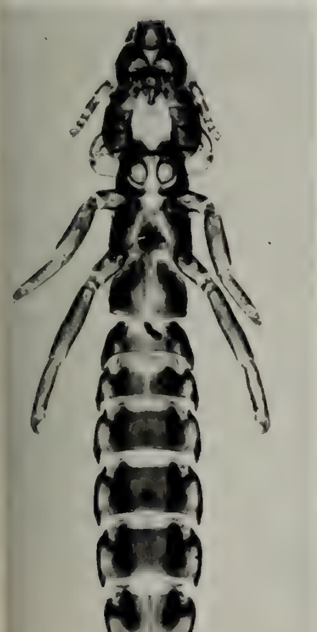
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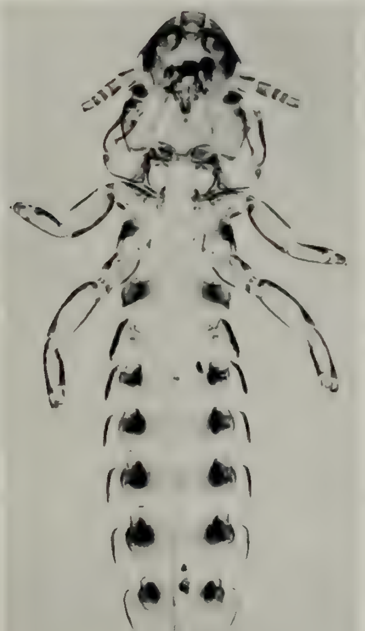
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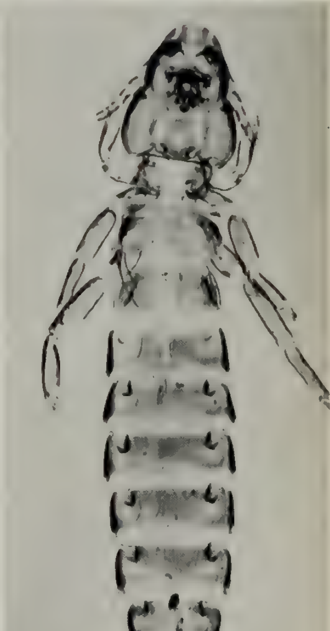
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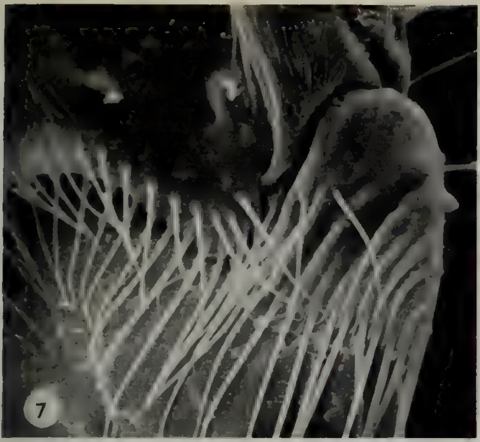
## PLATE 2

FIG. 7. *Pectinopygus dispar*. Vulval edge.
FIG. 8. *Pectinopygus varius*. Vulval edge.
FIG. 9. *Pectinopygus varius*. Bases of ♀ modified lateral setae.
FIG. 10. *Pectinopygus brevicornis*. Base of ♀ modified lateral setae.
FIG. 11. *Pectinopygus insularis*. ♀ genital region.
FIG. 12. *Pectinopygus insularis*. Vulval edge
(SEM).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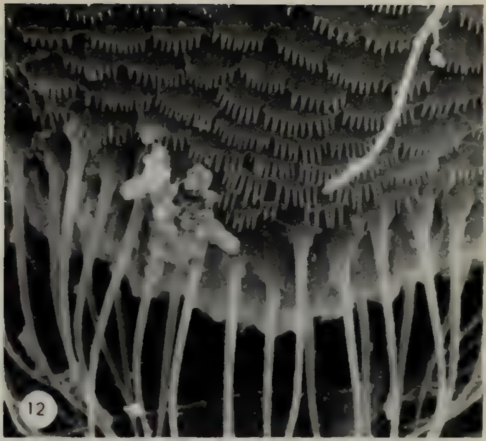
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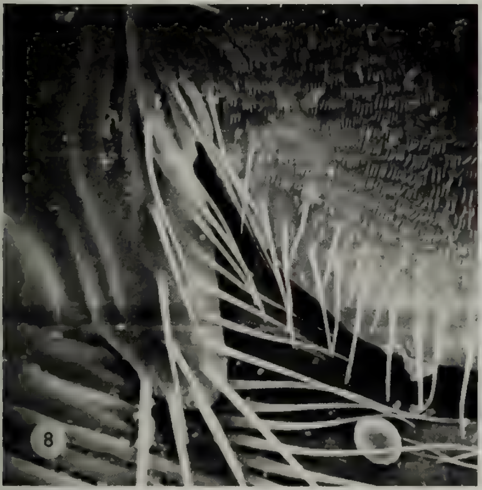
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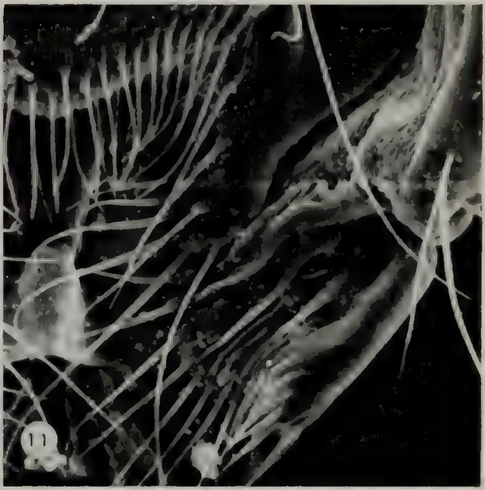
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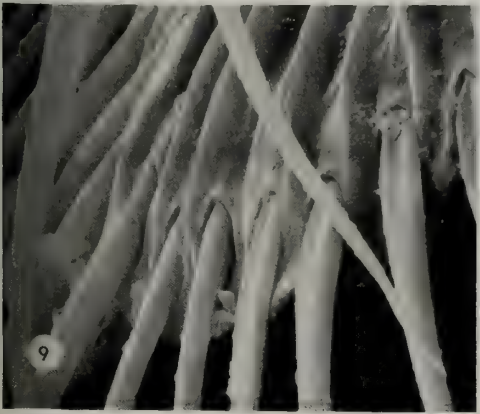
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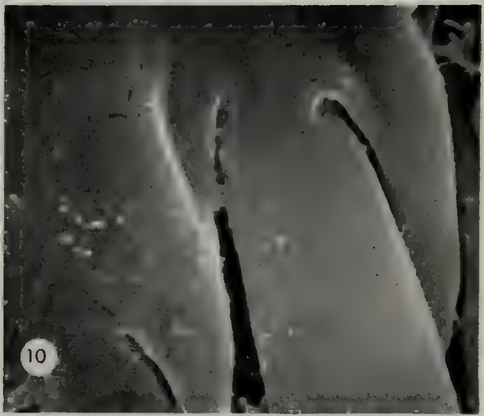
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## PLATE 3

FIG. 13. *Pectinopygus varius.* ♀ sheathed anal seta and sense organ (SEM).

FIG. 14. *Pectinopygus varius.* Anal sense organ (SEM).

FIG. 15. *Pectinopygus acutofasciatus.* Part of ♀ terminal sternum. Arrow points to one of the unmodified lateral setae.

FIG. 16. *Pectinopygus insularis.* Lateral part ♀ terminal sterna.

FIG. 17. *Pectinopygus timmermanni.* ♀ terminal sterna. Arrow points to single unmodified lateral seta.

FIGS 18–19. *Pectinopygus afer.* ♂ genitalia.

FIG. 20. *Pectinopygus dispar.* ♀ sheathed anal setae (SEM).

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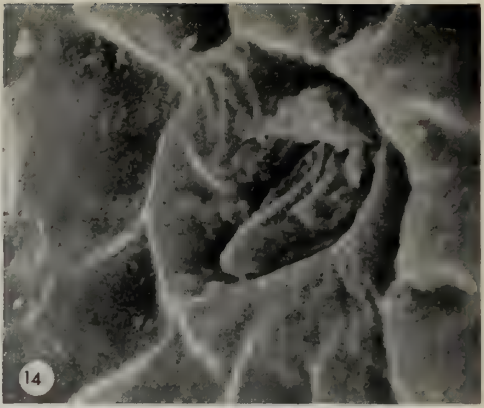
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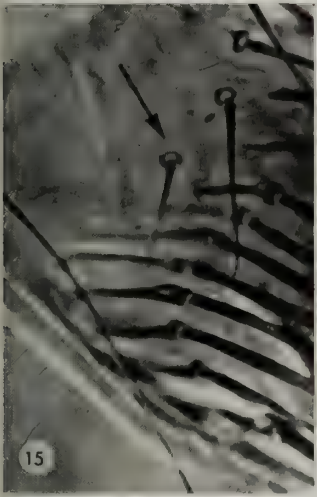
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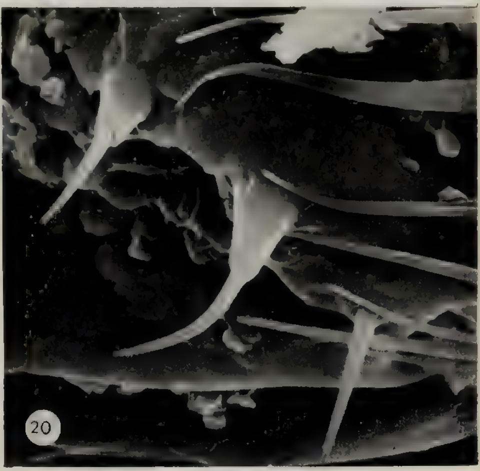
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BRITISH MUSEUM

# THE GENUS *ALOEIDES* AND ALLIED GENERA (LEPIDOPTERA : LYCAENIDAE)

G. E. TITE

AND

C. G. C. DICKSON

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
ENTOMOLOGY Vol. 29 No. 5
LONDON : 1973

# THE GENUS *ALOEIDES* AND ALLIED GENERA (LEPIDOPTERA : LYCAENIDAE)

MUSEUM
11 APR 1974
NATURAL HISTORY

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*Pp.* 225–280; 5 *Plates*, 32 *Text-figures*

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# THE GENUS *ALOEIDES* AND ALLIED GENERA (LEPIDOPTERA : LYCAENIDAE)

*By* G. E. TITE & C. G. C. DICKSON

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## SYNOPSIS

The genus *Phasis* Hübner as interpreted by Aurivillius (1924 : 424–431) is revised, and its species allocated to nine genera, five of which are new. With the exception of those already dealt with (Tite & Dickson, 1968 : 367–388), all species of *Aloeides* are included, eight new species and eight new subspecies being described and figured. Keys are provided for the genera, and for the species and most of the subspecies of *Aloeides*. Details of the life histories of two species are given, and addenda to 'The *Aloeides thyra* complex' (Tite & Dickson, loc. cit). are included, with a description of yet another new species.

## INTRODUCTION

In the course of the study of the *Aloeides thyra* complex, it was often found necessary to consider other members of the genus, and this led to the conviction that these other species presented many unsolved problems. To define the very homogeneous group of species here included in the genus *Aloeides*, it has been found necessary to make a reappraisal of the taxa dealt with by Aurivillius (1924 : 424–431) under the genus *Phasis* Hübner. That author divided *Phasis* into three subordinate groups as follows: 1. *Phasis*; 2. *Aloeides*; and 3. *Poecilmitis* and *Chrysoritis*. Examination of the species included under these headings leads to the conclusion that certain of them are misplaced, that differences of more than subgeneric value are involved, and that the introduction of five new genera is desirable. There is a possibility that the genera *Poecilmitis* and *Chrysoritis* are also in need of revision, but this is beyond the scope of the present work, and it is not proposed to deal with them in detail. In the case of the other genera, the known species are listed in the text. Clark & Dickson (1956 : 195–215) have included many of the species concerned in their suggested classification of the Lycaenid genera, founded on characters obtaining in the early stages. It is gratifying to note how well their classification does agree with that given below, which was first evolved from characters appertaining to the adult stage. A definitive adult character is that in certain genera the lower extremity of the tibia in the first and second pair of legs is furnished with a strong, slightly curved, downwardly directed spur, very similar to that found in the same position on the fore legs of the European *Plebejus argus* (L.). The presence or absence of this spur serves to divide the nine genera here defined into two groups. It is known that the wing-venation of butterflies may be variable, as are most other characters frequently used as aids to classification. All the venational characters mentioned below are found to be constant in all the specimens examined; it is deemed therefore that they, in conjunction with other characters, do have generic value.

To avoid much repetition in the drawing up of the descriptions of the species of *Aloeides*, the terminology of the wing characters used in dealing with the *Aloeides thyra* complex (Tite & Dickson 1968 : 370–371, text-figs 1 & 2) has been followed. It should be remembered that in the species now under discussion the discoidal fascia on the underside of the hind wing is broken up into separate spots. A general diagnosis of the male genitalia of the genus *Aloeides* is given by Stempffer (1967 : 174–175) and, as far as the *thyra* complex is concerned, these organs do not furnish any distinctive specific characters; in the remainder of the genus, however, they do in many cases exhibit small differences which, taken in conjunction with external characters, do serve as an aid to identification.

## ACKNOWLEDGEMENTS

In the compilation of this work, much generous aid, loan of specimens, and advice has been received from so many people and institutions. The authors wish to express their grateful appreciation to the following: the authorities of the British Museum (Natural History), in particular to Dr P. Freeman, Keeper of Entomology, Mr J. P. Doncaster, and Miss Susan May who is responsible for the drawings of genitalia; the authorities of the Hope Department, University Museum, Oxford, in particular to Professor G. C. Varley; the authorities of the Transvaal Museum, Pretoria, in particular to Dr L. Vari; the authorities of the Naturhistoriska Riksmuseum, Stockholm, in particular to Dr Per Inge Persson; the National Museum of Rhodesia, in particular to Dr Elliot Pinhey; Mr N. A. Brauer of Queenstown, Cape Province; Dr C. B. Cottrell of Salisbury, Rhodesia; Mr A. J. Duke and his son Neville of Salisbury, Rhodesia; Mr W. Henning and his sons

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## ABBREVIATIONS

In the lists of paratypes and other specimens studied which follow the descriptions, the depository of the specimens concerned is indicated by the following abbreviations:

| | |
|---|---|
| BMNH | British Museum (Natural History), Cromwell Road, London, SW7 5BD. |
| UM, Oxford | University Museum, Parks Road, Oxford. |
| TM, Pretoria | Transvaal Museum, P.O. Box 413, Pretoria, Republic of South Africa. |
| NR, Stockholm | Naturhistoriska Riksmuseum, Stockholm 50, Sweden. |
| NMR, Bulawayo | National Museum of Rhodesia, P.O. Box 240, Bulawayo, Rhodesia. |
| B. | N. A. Brauer collection. |
| Henn. | W. Henning collection. |
| Kr. | D. M. Kroon collection. |
| McM. | J. C. McMaster collection. |
| Penn. | K. M. Pennington collection. |
| Pl. | D. C. H. Plowes collection. |
| Q. | C. D. Quickelberge collection. |
| D. | C. G. C. Dickson collection. |

## KEY TO THE GENERA

1 Spur at the lower extremity of the tibia absent on all legs . . . . . 2

– Spur at the lower extremity of the tibia present on the first and second pairs of legs . . . . . . . . . . . . 5

2 (1) Vein 5 of the fore wing arising much nearer the origin of vein 6 than that of vein 4; vein 10 arising far from the origin of vein 7. Large species, the fore wing length between 16 and 26 mm . . . . . . . . 3

– Vein 5 of the fore wing arising only slightly nearer the origin of vein 6 than that of vein 4; vein 10 arising near the origin of vein 7. Small species, the fore wing length between 12 and 15 mm . . . . . . . . 4

3 (2) Vein 7 of the fore wing arising near the junction of vein 6 and the discocellular vein (Text-fig. 1) . . . . . . . . . . **PHASIS** (p. 231)

– Vein 7 of the fore wing arising well beyond the junction of vein 6 and the discocellular vein (Text-fig. 9) . . . . . **TYLOPAEDIA** (p. 232)

4 (2) Vein 8 of the fore wing present . . . . **POECILMITIS** (p. 230)

– Vein 8 of the fore wing absent or but weakly developed ***CHRYSORITIS*** (p. 230)

5 (1) Palpi with a dense fringe of long, dark, pointed hair-like scales along the ventral side of the second segment. Vein 7 of the fore wing arising just before the junction of vein 6 and the discocellular vein; vein 10 arising far from the origin of vein 7 (Text-fig. 11) . . . ***OXYCHAETA*** (p. 232)

– Palpi smooth, or smooth with a scattering of long, ribbon-like blunt-ended scales (some *Aloeides* only). Vein 7 of the fore wing arising at or beyond the junction of vein 6 and the discocellular vein; vein 10 arising near the origin of vein 7 6

6 (5) Vein 7 of the fore wing arising well beyond the junction of vein 6 and the discocellular vein (Text-fig. 13) . . . . . ***ARGYRASPODES*** (p. 233)

– Vein 7 of the fore wing arising from or very near the junction of vein 6 and discocellular vein . . . . . . . . . . . 7

7 (6) Vein 5 of the fore wing arising much nearer the base of vein 6 than that of vein 4 (Text-fig. 5) . . . . . . . . . . ***TRIMENIA*** (p. 233)

– Vein 5 of the fore wing arising only slightly nearer the base of vein 6 than that of vein 4 . . . . . . . . . . . 8

8 (7) Vein 7 of the fore wing arising just before the junction of vein 6 with the discocellular vein; vein 3 arising before the junction of vein 4 with the discocellular vein (Text-fig. 7) . . . . . . ***ARGYROCUPHA*** (p. 234)

– Vein 7 of the fore wing arising a long distance before the junction of vein 6 with the discocellular vein; vein 3 arising from the point of junction of vein 4 and the discocellular vein (Text-fig. 3) . . . . . ***ALOEIDES*** (p. 235)

## ***POECILMITIS*** Butler

(Text-figs 15, 16)

*Poecilmitis* Butler, 1899 : 32. Type-species: *Zeritis lycegenes* Trimen, by original designation.
[*Phasis* Hubner; Aurivillius, 1898 : 340, partim.]
[*Phasis* Hubner; Aurivillius, 1924 : 431, partim.]
*Poecilmitis* Butler; Stempffer, 1967 : 176.

In addition to the characters mentioned in the key; on the fore wing vein 3 arises a short distance before the cross-vein, and vein 7 originates just before but very close to the cross-vein; on the hind wing vein 3 arises just beyond the cross-vein, vein 5 arises nearer to the origin of vein 6 than to that of vein 4, and vein 7 originates just basad of the cross-vein. The early stages belong to the Clark and Dickson group L. Cross-sections of the larval segments in the Clark and Dickson figures indicate the flattened shape of the larva, and show the affinity of the genus with *Chrysoritis* and *Oxychaeta*, and its wide separation from all other genera here dealt with. As far as they are known, the larvae are vegetarian feeders, but are attended by ants. The life-histories of *P. lycegenes* and numerous other species are given by Clark & Dickson (1971).

## ***CHRYSORITIS*** Butler

*Chrysoritis* Butler, 1898 : 848. Type-species: *Zeritis oreas* Trimen, by original designation.
[*Phasis* Hübner; Aurivillius, 1898 : 340, partim.]
[*Phasis* Hübner; Aurivillius, 1924 : 431, partim.]
*Chrysoritis* Butler; Stempffer, 1967 : 179.

In the fore wing, vein 9 is either absent or very weak. In all other respects the characters are the same as those of *Poecilmitis*, and it is doubtful if the two can be retained as separate genera.

## ***PHASIS*** Hübner

(Text-figs 1, 2)

*Phasis* Hübner, 1819 : 73. Type-species: *Papilio salmoneus* Cramer [ = *Papilio thero* L.], by subsequent designation (Scudder, 1875 : 247).
*Phasis* Hübner; Aurivillius, 1988 : 340, partim.
*Phasis* Hübner; Aurivillius, 1924 : 424, partim.
*Pseudocapys* Murray, 1935 : 106. Type-species: *Papilio salmoneus* Cramer [ = *Papilio thero* L.], by original designation on the unjustified assumption that *Papilio pierus* Cramer was the type-species of the genus *Phasis*.

*Palpi* with the second segment adorned with long, blunt-ended, ribbon-like scales. *Antennae* fairly short, about half the length of the costa of the fore wing, dark brown in colour and tipped with orange.

*Wings*. The fore wing distal margin is strongly produced at vein 5, and concave between that vein and vein 2. The hind wing is slightly produced at vein 5 and then concave to vein 2, with a short tail at vein 2 and another at vein 1.

The *early stages* fall into the Clark and Dickson group E, the larvae being attended by ants, but are vegetarian feeders.

### SPECIES OF *Phasis*

### ***Phasis thero*** (L.)

*Papilio thero* L., 1764 : 328, Cape.
*Papilio rumina* Drury, 1773 : pl. 2, fig. 1.
*Papilio salmoneus* Cramer, 1781 : 99, pl. 341, figs D–E, Cape of Good Hope.
*Papilio erosine* Fabricius, 1787 : 51, Cape of Good Hope.
*Papilio pulsius* Herbst, 1793 : pl. 156, figs 6–7.
*Phasis thero* (L.) Clark & Dickson, 1971 : 193–197, pl. 93, figs 1–5. [Life-history.]

### ***Phasis clavum*** Murray

*Phasis clavum* Murray, 1935 : 104. Holotype ♂, CAPE PROVINCE: Nieuwoudtville Mts (TM, Pretoria).
*Phasis clavum* Murray; Clark & Dickson, 1971 : 201–204, pl. 95, figs 8–9, 11–12. [Life-history].

### ***Phasis braueri*** Dickson

*Phasis braueri* Dickson, 1968*b* : 267, pl. 15. Holotype ♂, CAPE PROVINCE: Queenstown (BMNH) [examined].
*Phasis braueri* Dickson; Clark & Dickson, 1971 : 197–201, pl. 94, figs 1–22. [Life-history].

## *TYLOPAEDIA* gen. n.

(Gr. τυλὸ–knobbed, παεδια–child)

(Text-figs 9–10)

Type-species: *Zeritis sardonyx* Trimen.

***Palpi*** smooth, the second segment covered with scales of uniform length. *Antennae* short, less than half the length of the fore wing costa; they are dark brown in colour, of somewhat lighter hue below.

*Wings* differ from those of *Phasis* in shape as follows: the fore wing distal margin is only slightly produced at vein 5; the hind wing has a distinct tooth at vein 4, and another at vein 1, the margin between them being slightly concave, and crenulate.

*Early stages.* These were placed by Dickson and Clark in their group F. From their figures, it would appear likely that they might better be placed in a separate group; the flattened egg, and the club-like form of the dorsal setae in the young larva render them unlike any of the other members of group F, all of which are *Aloeides.*

Aurivillius placed *sardonyx* in his *Phasis* subgenus *Poecilmitis*, but it is surely more nearly related to *Phasis thero*; its size, shape, venation, and larval characters all confirm this.

### SPECIES OF *Tylopaedia*

### ***Tylopaedia sardonyx*** (Trimen) **comb. n.**

*Zeritis sardonyx* Trimen, 1868 : 83, pl. 5, fig. 5, pl. 6, figs 6–7. Holotype ♂, CAPE PROVINCE: Murraysburg (BMNH) [examined].

*Phasis sardonyx* ab. *peringueyi* Aurivillius, 1924 : 430, CAPE PROVINCE.

*Phasis sardonyx peringueyi* Aurivillius; Dickson, 1969*b*: 213, pl. 9. [Alteration of status].

*Phasis sardonyx* f. *knobeli* van Son, 1959 : 56, CAPE PROVINCE.

*Phasis sardonyx* (Trimen) Clark & Dickson, 1971: 204–208, pl. 96, figs 1–4. [Life history].

## *OXYCHAETA* gen. n.

(Gr. ὀξυς–pointed, χαττη–hair)

(Text-figs 11–12)

Type-species: *Phasis dicksoni* Gabriel.

*Palpi.* The second segment is furnished with a dense covering of long sharply pointed hair-like scales, these scales being very different in shape from the flattened blunt-ended ones to be found in the same situation in *Phasis.*

*Antennae* short, less than half the length of the fore wing costa.

*Wings.* The fore wing is rather long, its apex obtuse, and its distal margin evenly convex; vein 3 arises from the median vein a long way before the cross-vein, and vein 5 arises considerably nearer to vein 6 than to vein 4. The rounded hind wing is without tails or tornal projections; vein 3 arises only a short way before the cross-vein, and vein 5 arises approximately mid-way between the origins of veins 4 and 6.

*Early stages.* The flattened shape of the larva suggests some affinity with *Poecilmitis.* It belongs to the Clark and Dickson group M.

### Species of *Oxychaeta*

### ***Oxychaeta dicksoni*** (Gabriel) **comb. n.**

*Phasis dicksoni* Gabriel, 1947 : 60. Holotype ♂, Cape Province: Near Melkbosch Strand (BMNH) [examined].

*Phasis dicksoni* Gabriel; Clark & Dickson, 1971 : 189–193, pl. 92, figs 1–4, pl. 95, figs 3–10. [Life history].

## ***ARGYRASPODES* gen. n.**

(From *argyraspis* and Gr. ωδης – having the form of)

(Text-figs 13, 14)

Type-species: *Zeritis argyraspis* Trimen.

*Palpi* smooth, the scales on the second segment are of equal length. *Antennae* brown in colour, long, over half the length of the fore wing costa.

*Wings*. The fore wing distal margin is produced at vein 5, and slightly produced at vein 2 on the hind wing, veins 1 and 2 are produced, the margin between vein 2 and vein 4 being concave.

*Early stages*. These are not included in Clark and Dickson's classification.

### Species of *Argyraspodes*

### ***Argyraspodes argyraspis*** (Trimen) **comb. n.**

*Zeritisa agyraspis* Trimen, 1873 : 114. Syntypes, Cape Province: between Somerset E. and Murraysburg (*J. H. Bowker*), 1 ♂ (BMNH); Murraysburg (*Mushett*), 1 ♂ (BMNH); Burghersdorp (*Kannemeyer*), 1 ♀ (depository unknown); Beaufort W. (*E. L. Layard*), sex unknown (depository unknown) [BMNH syntypes examined].

*Phasis argyraspis* f. *labuschagnei* van Son, 1959 : 57. Holotype ♂, Botswana: Nossob River Bed, 10 miles N. of Twee Rivieren, Kalahari Gemsbok National Park, 11–20.ii.1958 (*G. van Son*) (TM, Pretoria).

## ***TRIMENIA* gen. n.**

(Text-figs 5–6)

Type-species: *Zeritis wallengreni* Trimen.

*Palpi* smooth as in previous genus. *Antennae* long.

*Wings*. The fore wing distal margin is angled at vein 5, and concave from that point to the tornus. The tornus of the hind wing is produced, and in some examples there is a tooth at vein 2. On the fore wing, vein 3 arises a long way before the discocellular vein; vein 7 arises just beyond the origin of vein 6; vein 10 arises nearer to the origin of vein 7 than in that of any other genus under review. On the hind wing, vein 3 arises only a short distance before the discocellular vein; vein 5 arises near to vein 6 than to vein 4.

*Early stages*. These are not included in Clark and Dickson's classification.

## Species of *Trimenia*

### ***Trimenia wallengreni*** (Trimen) **comb. n.**

*Zeritis wallengreni* Trimen, 1887 : 192. Holotype ♂, Cape Province: Stellenbosch (BMNH) [examined].
*Phasis wallengreni* (Trimen) Clark & Dickson, 1971 : 208–209, pl. 97, figs 1–4. [Life-history].

### ***Trimenia argyroplaga argyroplaga*** (Dickson) **comb. n.**

*Phasis argyroplaga* Dickson, 1967*b* : 268. Holotype ♂, Cape Province: Karroo Hills between Matroosberg (formerly Triangle) Railway Station and Eendracht (BMNH) [examined].
*Phasis agryroplaga* Dickson; Clark & Dickson, 1971 : 209–212, pl. 98, figs 1–6. [Life-history].

### ***Trimenia argyroplaga wykehami*** (Dickson) **comb. n.**

*Phasis argyroplaga wykehami* Dickson, 1969*a* : 285. Holotype ♂, Cape Province: Summit of Nieuwveld Mts, near Beaufort West (BMNH) [examined].

### ***Trimenia macmasteri*** (Dickson) **comb. n.**

*Phasis macmasteri* Dickson, 1968*a* : 89. Holotype ♂, Cape Province: Vlekpoort, near Hofmayr (BMNH) [examined].

## ***ARGYROCUPHA*** **gen. n.**

(Gr. *αργυρος* – silver, *κουφος* – light)

(Text-figs 7–8)

Type-species: *Cigaretis malagrida* Wallengren.

*Palpi* smooth. *Antennae* just over half the length of the fore wing costa.

*Wings.* Margins slightly crenulate, with feeble projections at veins 1 and 2 on the hind wing. In addition to the characters mentioned in the key, vein 5 of the hind wing arises much nearer to the origin of vein 6 than to that of vein 4.

*Early stages.* These belong to the Clark and Dickson group C.

## Species of *Argyrocupha*

### ***Argyrocupha malagrida malagrida*** (Wallengren) **comb. n.**

*Cygaretis malagrida* Wallengren, 1857 : 43. Holotype ♂, 'Caffraria' (recte Cape Peninsula) (NR, Stockholm).
*Phasis malagrida* (Wallengren) Clark & Dickson, 1971 : 212–213, pl. 99, figs 1–8. [Life-history].

### ***Argyrocupha malagrida paarlensis*** (Dickson) **comb. n.**

*Phasis malagrida paarlensis* Dickson, 1967*b* : 123. Holotype ♂, Cape Province: Paarl Mountain (BMNH) [examined].

## *ALOEIDES* Hübner

(Text-figs 3, 4)

*Aloeides* Hübner, 1819 : 73. Type-species: *Papilio pierus* Cramer, by subsequent designation (Scudder, 1875: 107).
[*Phasis* Hübner; Aurivillius, 1898 : 337, partim.]
[*Phasis* Hübner; Aurivillius, 1924 : 424, partim.]
[*Phasis* Hübner; Murray, 1935 : 113, partim.]
*Aloeides* Hübner; Stempffer, 1967 : 173, partim.
*Aloeides* Hübner; Tite & Dickson, 1968 : 371.

*Palpi.* The second segment is smooth with scales of equal length, or, in some species, with a scattering of long, flattened, ribbon-like scales.

*Antennae* approximately half the length of the fore wing costa.

*Wings.* The fore wing distal margin is evenly convex, without an obvious projection at vein 5. The hind wing is oval in shape, its margin crenulate; in certain species the tornus is noticeably produced at vein 1 and sometimes at vein 2, but there is never a true tail.

*Early stages.* Clark and Dickson group F. As far as is known, the larvae are vegetarian though attended by ants, *A. dentatis* being a possible exception (see p. 274).

### KEY TO THE SPECIES

1 Aedeagus externally smooth without patches of numerous recurved hooks (Text-fig. 17). Upperside of wings bright tawny orange with black-brown borders, and a large black-brown apical patch on the fore wing. Underside of hind wing often with a cloudy dark band placed just distally to the median series (Pl. 1, figs 33–41, 43–46, 52–60, 62–65) . . **molomo** (p. 239)

– Aedeagus externally with one or two patches of numerous recurved hooks. Upperside of wings tawny orange with black-brown borders, or completely dark brown or grey-brown, or mainly leaden silver. Underside of hind wing without a cloudy dark band placed distally to the median series . 2

2 (1) Upperside of wings mainly leaden silver, in the female with a subapical orange patch on the fore wing (Pl. 1, figs 48–49) . . . . **barklyi** (p. 243)

– Upperside of wings tawny orange with dark borders, ochreous with dark borders, or completely dark brown or grey-brown . . . . . . 3

3 (2) Upperside of wings usually tawny orange with black-brown borders, in some males the tawny orange may be absent . . . . . . . . 4

– Upperside of wings in the males at least mainly grey-brown or warm red-brown, in some cases with obscure straw or ochreous areas in the submarginal region. Never tawny orange in the male . . . . . . . 5

4 (3) Underside of hind wing with the median series consisting of conjoined spots which form a serpentine or zig-zag band, which usually coalesces with the discoidal fascia . . . . . . . . . . **thyra** group (Tite & Dickson, 1968 : 367–388)

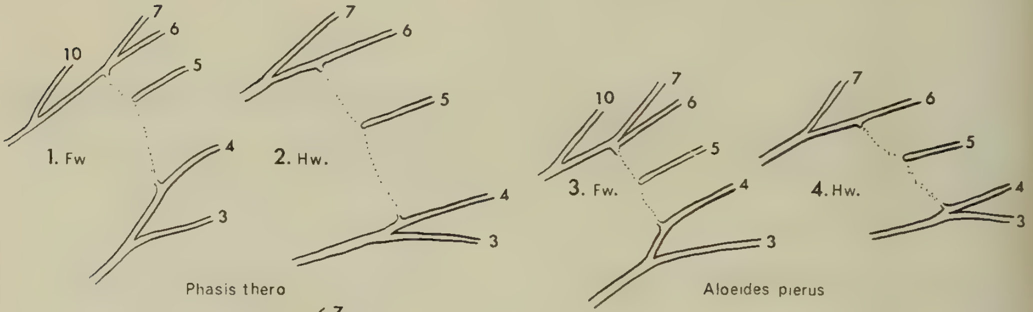
– Underside of hind wing with the median series consisting of well separated spots, which do not coalesce with the discoidal spots . . . . 10

5 (3) Apex of fore wing in the ♂ acute . . . . . . . . . 6

– Apex of fore wing in the ♂ less acute. Upperside of ♂ mainly dark brown. Upperside ♀ as in ♂, but in some cases with tawny orange markings . . 7

6 (5) Upperside of wings washed with straw or tawny yellow in the ♂ (Pl. 1, fig. 50; Pl. 2, figs 71, 73). Upperside of wings tawny orange with dark margins and apical patch in the ♀ (Pl. 1, figs 42, 47, 51; Pl. 2, fig. 72). From Central and East Africa only . . . . . . . . . **conradsi** (p. 245)

Upperside of wings mainly dark brown, but peppered with ochreous scales, some individuals with pale orange-yellow areas in the outer portions of all wings; fore wings in both sexes with a series of four dusky median spots situated in areas 2, 3, 4, and 5 (Pl. 2, figs 74, 83). (Such spots are not present in any other member of the genus.) Only known from Angola **angolensis** (p. 249)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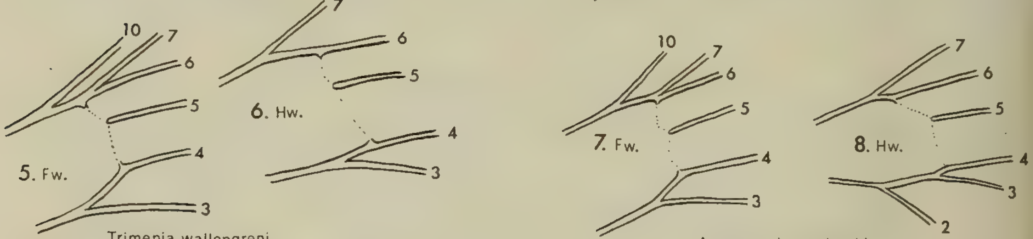
Phasis thero

Aloeides pierus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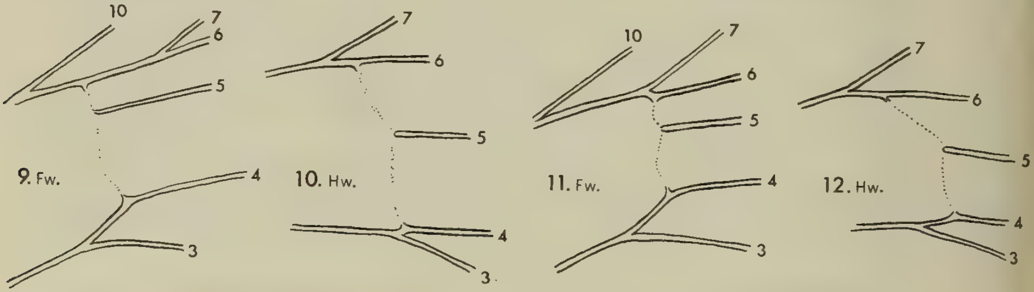
Trimenia wallengreni

Argyrocupha malagrida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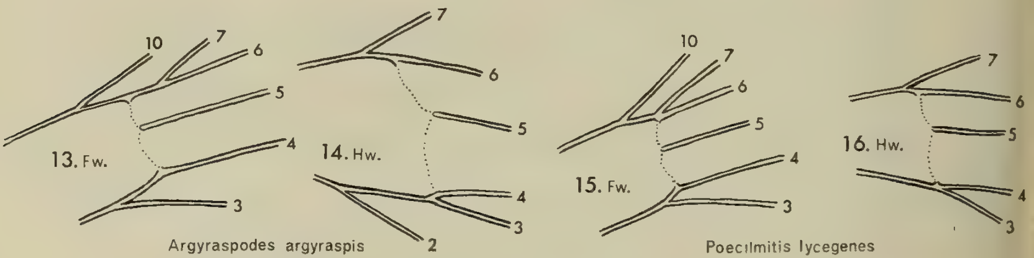
Tylopaedia sardonyx

Oxychaeta dicksoni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16. Hw.
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Argyraspodes argyraspis

Poecilmitis lycegenes

FIGS 1–16. Part of the wing-venation of *Aloeides* and allied genera. (Fw = fore wing, Hw. = hind wing).

7 (5) Upperside of wings warm red-brown with a velvety texture (Pl. 3, fig. 108). ♀ unknown **stevensoni** (p. 250)

– Upperside of wings ♂ dark brown with a non-velvety texture. ♀ as in ♂, but in some cases with tawny orange areas 8

8 (7) Upperside of wings in both sexes dull dark brown (Pl. 2, figs 75, 76). Underside of fore wing grey-brown, never tawny orange (Pl. 2, figs 92, 93) **griseus** (p. 251)

– Upperside of wings in ♂ dull dark brown with obscure pale submarginal spots. ♀ as ♂, but often with tawny orange areas. Underside of fore wing in both sexes mainly tawny orange 9

9 (8) Upperside of fore wing with the uppermost pale submarginal spot not directed towards the apex (Pl. 2, figs 77, 78). Underside of fore wing with the spot in the median series in area 2 placed only slightly nearer the margin than is the double spot in area 1; in many examples the median spots in areas 1, 2, 3, and 4 are placed in a straight diagonal line (Pl. 2, figs 94, 95). Underside of hind wing with a definite spot pattern, but never so strongly marked as in *plowesi* **taikosama** (p. 251)

– Upperside of fore wing with the uppermost pale submarginal spot directed outwards towards the apex (Pl. 2, figs 79, 80). Underside of fore wing with the spot of the median series in area 2 placed immediately below the spot in area 3, and much nearer the margin than is the double spot in area 1; the spots in areas 1, 2, 3, and 4 are never placed in a straight diagonal line (Pl. 2, figs 96, 97). Underside of wings very ornate, on the hind wing the pattern strongly marked, the spots with silver centres **plowesi** (p. 252)

10 (4) Labial palpi with long ribbon-like scales on the ventral portion of the second segment **susanae** (p. 253)

– Labial palpi without long ribbon-like scales on the ventral portion of the second segment 11

11 (10) Hind wing with tornus not noticeably produced at vein 1. Male genitalia with a distinct tooth or projection on the dorsal edge of the clasper 12

– Hind wing with the tornus noticeably produced at vein 1. Male genitalia without a distinct tooth or projection on the dorsal edge of the clasper 15

12 (11) Underside of hind wing with the median series broken at vein 3 or vein 4 13

– Underside of hind wing with the median series variable, but not clearly broken at vein 3 or vein 4 14

13 (12) Underside of hind wing with the median series broken at vein 3, the spot in area 3 being missing or barely indicated (Pl. 2, figs 101–104; Pl. 3, figs 122–124) **damarensis** (p. 256)

– Underside of hind wing with the median series broken at vein 4, the spots in areas 4 to 6 being situated far distad of the spots in areas 2 and 3 (Pl. 3, figs 127–129) **pierus** (p. 259)

14 (12) Upperside of wings with the tawny orange areas in the ♂ sometimes absent, and always less in extent than the dark brown areas (Pl. 3, figs 109, 113–117) Underside of hind wing with the median series not sharply emphasized (Pl. 3, figs 126, 130–134) **trimeni** (p. 260)

– Upperside of wings with the tawny orange areas always present, and greater in extent than the dark brown areas (Pl. 3, figs 118, 119). Underside of hind wing with the median series strongly emphasized, often taking the form of a continuous band (Pl. 3, figs 135, 136) **swanepoeli** (p. 262)

15 (11) Upperside of wings with the tawny orange areas of a deep rich colour. Male genitalia with the dorsal edge of the clasper slightly angled 16

– Upperside of wings with the tawny orange areas of a paler, more yellowish tinge (Pl. 3, figs 120, 121; Pl. 4, figs 139–148). Male genitalia with the dorsal edge of the clasper rounded, without any angle or tooth (Text-fig. 28) **aranda** (p. 264)

15 (15) Fore wing in the male short, its apex moderately acute and its distal margin only slightly convex (Pl. 4, figs 149, 150). Male genitalia with the aedeagus having only one patch or recurved hooks situated on the right-hand side (Text-fig. 30) ***henningi*** (p. 267)

– Fore wing in the male long, its apex moderately obtuse and its distal margin more strongly convex. Male genitalia with the aedeagus having two patches of recurved hooks, one on each side . . . . . . . 17

17 (16) Fore wing moderately long (Pl. 4, figs 154, 155). From Knysna and more western parts of Cape Province . . . . . . ***almeida*** (p. 268)

– Fore wing longer and narrower. From the eastern Cape Province ***macmasteri*** (p. 269)

## ***Aloeides molomo*** (Trimen)

Superficially, this species shows resemblance to some examples of *A. damarensis*; it differs by its smaller size, and by its wider dark margins on all wings. In all subspecies with the exception of those from Tanzania and Malawi, the underside of the hind wing is characterized by the presence of a cloudy dark transverse band situated between the median series and the submarginal series of spots.

The male genitalia differ from all other members of the genus in the following characters: the aedeagus is externally smooth without patches of recurved hooks, but usually with a strongly sclerotized two- or three-pointed structure on the dorsal surface near the orifice, and with a smaller but similar structure on the left-hand side of the organ (in one example both structures are absent; the preparation appears to be complete, but it is possible that they have been accidentally detached); the clasper is furnished with a point on both the dorsal and the ventral edge, that of all other species having at the most a point or prominence on the dorsal edge only; the juxta is bifid, the two halves each terminating in a point. (Text-fig. 17j.)

### KEY TO THE SUBSPECIES

1 Underside of hind wing with the cloudy dark band in the median area heavily marked . . . . . . . . . . . . . 2

– Underside of hind wing with the cloudy dark band in the median area but feebly indicated . . . . . . . . . . . . . 5

2 (1) Underside of fore wing with the submarginal spots rounded and well separated 3

Underside of fore wing with the submarginal spots elongate and tending to coalesce, giving the appearance of a continuous band (Pl. 1, figs 57, 58). (Rhodesia) . . . . . . . . . ***m. coalescens*** (p. 241)

3 (2) Upperside of all wings rich tawny orange (Pl. 1, figs 33–35). (Eastern Cape Province; Orange Free State; Transvaal) . . . ***m. molomo*** (p. 239)

– Upperside of all wings pale tawny orange . . . . . . . 4

4 (3) Upperside of fore wing with the distal band narrow, approximately 2 mm in width at vein 3 (Pl. 1, figs 36, 37) (N. W. Cape Province; Botswana) ***m. krooni*** (p. 240)

– Upperside of fore wing with the distal band wide, approximately 3 mm in width at vein 3 (Pl. 1, figs 40, 41). (Only known from Mumbwa, Zambia ***m. mumbuensis*** (p. 241)

5 (1) Upperside of fore wing with the apical patch and distal band very extensive, the latter approximately 5 mm in width at vein 3 (Pl. 1, figs 43, 44). (Tanzania) . . . . . . . . . ***m. kiellandi*** (p. 242)

### *Aloeides molomo molomo* (Trimen)

(Pl. 1, figs 33–35 and 52–54; Text-figs 17a, j, and c)

*Zeritis molomo* Trimen, 1870 : 373, pl. vi, fig. 9. Holotype ♀, LESOTHO: Koro Koro (depository unknown).
*Zeritis molomo* Trimen; Trimen, 1887 : 205 (partim).
*Zeritis molomo* Trimen; Trimen, 1904 : 238, pl. xix, figs 4, 4a, Johannesburg.

Length of fore wing: ♂ 14–16 mm; ♀ 14–17·5 mm.

♂. The upperside is bright tawny orange, this colour extending from the base to the distal band on all wings, and on the fore wing reaching to the basal part of the costa. On the fore wing, the black-brown distal margin is wide, approximately 3 mm at vein 2. The apical patch is large, but usually bisected by three tawny orange dots extending towards the costa; these dots may be quite small, or in some individuals can be so large, that they in fact form a link between the tawny orange area and the costa, only broken by the darkened veins. The apical patch of the hind wing is variable, sometimes stopping short at vein 4, sometimes extending beyond that vein towards the tornus in a series of spots.

♀. Apart from some reduction in the black-brown markings, and the usual difference in shape, this sex is like the male.

♂ ♀. The fringes are strongly chequered. Underside fore wing, the tawny orange ground is shaded to buff at the costal and distal margins; there are three silvery white centred, black ringed spots in the cell, and an indistinct spot in area 2 below the centre cell-spot; the median series is very irregular, the first spot being placed well basad, the second distad, and the fourth even more near the margin; the submarginal series are large, and have a touch of white to each spot inwardly. The marginal dots are present. The underside of the hind wing is sandy brown in colour, and decorated with the usual arrangement of spots. These spots are dull silver in hue, and are ringed narrowly with black; those of the median series are rounded, variable in size, and the second and fourth are placed well distad of the others. Beyond this series is the clouded dusky band mentioned in the key. The submarginal series is scarcely visible.

The whereabouts of Trimen's type of *molomo* is not known, but luckily the original figure is an excellent representation, and leaves no doubt as to the authenticity of the present use of the name. Trimen's action in redescribing *molomo* from Johannesburg specimens, and the labelling of some of them as types was unnecessary; these so-called types cannot be regarded as neotypes in view of the considerable distance of Johannesburg from the type-locality (*International Code of Zoological Nomenclature*, Article 75 (c)).

It has been suggested that the population in Lesotho and the Orange Free State differs from that inhabiting the Johannesburg district and other parts of the Transvaal, but the examples available from the first two localities are far too few to form the basis of any firm decision. It is however worth recording that a male from Ladybrand, O. F. S. is almost identical with the Johannesburg specimen figured by Trimen (1904 : fig. 4); both specimens differ from all other specimens examined from Johannesburg in that their dark margins are narrower and more sharply defined inwardly. The width of the dark margins is a variable character in Transvaal examples, but apart from the original of Trimen's figure 4, all his Johannesburg specimens, and the majority of other Transvaal examples studied, are of the wide banded form. On the other hand, of five males from Fairview Mine near Barberton sent by Mr Plowes, three are of the narrow and two are of the wide margined form, proving that in some areas at least both forms fly together. This question can only be finally settled when much more material is examined from all the localities concerned, and it is not intended at this time to attempt to designate a neotype. In the meantime, examples from all these areas can be considered as *molomo molomo*, the nominate locality being Koro Koro, Lesotho. Specimens from the eastern Cape Province (Queenstown, Cathcart and Klipplaat) are of the narrow bordered form like those from Ladybrand.

MATERIAL EXAMINED.

ORANGE FREE STATE: Ladybrand, xi. 1951 (*D. A. Swanepoel*), 1 ♂, 1 ♀ (BMNH); Hebron, 7.x.1945 (*A. L. Evans*), 2 ♂, 1 ♀ (TM, Pretoria); Sasolburg, ix–x. 1969 (*D. M. Kroon*), 3 ♂, 1 ♀ (Kr.). CAPE PROVINCE: Kimberley, 1898 (*C. Barber*) ex Trimen Coll., 1 ♂, 1 ♀ (BMNH); Cathcart, 1966 (*J. C. McMaster*), 3 ♂, 2 ♀ (McM); Queenstown, x. 1963 (*R. J. Southey*), 5 ♂, 3 ♀ (TM, Pretoria); Klipplaat, 6.iii. (*G. C. Clark*), 1 ♂ (TM, Pretoria). NATAL: Mt Ngwibi, ix. 1915, 2 ♀ (TM, Pretoria). TRANSVAAL: Johannesburg, 1898 (*C. Barber*) ex Trimen Coll., 1 ♂ (BMNH); Johannesburg, 1901–1902 (*Feltham*) ex Trimen Coll., 3 ♂, 1 ♀ (BMNH); Johannesburg, ex Distant Coll., 2 ♂, 3 ♀ (BMNH); Witwatersrand Hills, Johannesburg, 12.x.1902 (*Feltham*) ex Trimen Coll., 1 ♂, 3 ♀ (BMNH); Pietersburg, ii. 1947 (*Swanepoel*), 1 ♀ (BMNH); Struben's Valley, Florida, 1963–7 (*Henning*), 3 ♂, 3 ♀ (BMNH); Fairview Mine, Barberton, 12.x.1961 (*Plowes*), 5 ♂ (Pl.); Malta, x. 1965 (*Brauer*), 1 ♂, 1 ♀ (B); Johannesburg (*Ross*), 1 ♂, 1 ♀ (TM, Pretoria); Doornfontein, Potchefstroom District, 27.ix.1952 (*van Son*), 1 ♀ (TM, Pretoria); Muldersdrift, x. 1949 (*van Son*), 1 ♂, 1 ♀ (TM, Pretoria); Groenebloom, ix. 1951 (*H. Cookson*), 5 ♂ (TM, Pretoria); Rhenoster Kopje, Klerksdorp District, 2.x.1951 (*H. Cookson*), 1 ♂ (TM, Pretoria); White Heather Mine, 14.xi.1938 (*van Son*), 1 ♀ (TM, Pretoria); Wolkberg, 29.ix.1940 (*Swanepoel*), 1 ♀ (TM, Pretoria); Potgietersrust, xi. 1902 (*Burn*), 1 ♀ (TM, Pretoria).

### ***Aloeides molomo krooni*** **subsp. n.**

(Pl. 1, figs 36, 37, 55 and 56)

Length of fore wing: ♂ 13 mm; ♀ 14–15 mm.

♂. The upperside on all wings is paler in colour than in any other race; the dark margins are narrower, and the apical patch on the hind wing does not extend below the middle of area 5. On the fore wing, the tawny orange penetration of the apical patch forms a narrow finger-like projection, only weakly divided by a sparse scattering of dusky scales along the veins.

♀. Except for wing shape as in the male. The penetration of the apical patch is wider and the veins crossing it are not usually darkened.

♂ ♀. In contrast with the nominate race, the coloration of the underside is very much paler; the marginal areas of the fore wing and the ground colour of the hind wing are of a light sandy yellow hue. On the hind wing, the silver-white spotting is rendered somewhat obscure by lack of contrast with the pale ground. The cloudy transverse band is also rather less obvious.

Slightly smaller than *molomo molomo*, this race has all the appearance of being a product of the arid areas in which it lives. The above name is proposed as some recognition of the help and encouragement given by Dr D. M. Kroon of Sasolburg.

Holotype ♂, CAPE PROVINCE: Kuruman, 21–9.xi.1923, ex Cator Coll., B.M. Type No. Rh. 17216.

Paratypes. CAPE PROVINCE: Kuruman, 21–9.xi.1923, ex Cator Coll. (allotype ♀, B.M. Type No. Rh. 17217); data as allotype 2 ♂, 2 ♀ (BMNH); Upington, 14.iii.1950 (*Kettlewell*), 1 ♂ (BMNH); Dingle, 10.x.1946 (*Pennington*), 2 ♂ (TM, Pretoria); Kuruman, 8.iv.1933 (*van Son*); Tsabong, 15.xii.1955 (*Pennington*), 1 ♀ (TM, Pretoria). BOTSWANA: Ghanzi (*Maurice*) 3 ♂, 1 ♀ (BMNH); Machudi Station, 3,100′ 22.ix.1905 (*Dixey*), 1 ♂ (UM, Oxford); Okavango Swamp, Near Mann, Ngamiland, 3,000′, 5.i.1931 (*Hale-Carpenter*), 1 ♀ (UM, Oxford); Nkate, Makarikari, 6–23.viii.1930 (*V. L. Kalahari Expedition*), 5 ♂, 3 ♀ (TM, Pretoria).*

### *Aloeides molomo coalescens* subsp. n.

(Pl. 1, figs 38, 39, 57, and 58)

Length of fore wing: ♂ 14–15 mm; ♀ 15–17 mm.

♂. Very similar to that sex of *molomo molomo*; on the upperside the margins are wide, and in many individuals the apical patch of the hind wing is continued as a band to the tornus. The penetration of the apical patch is more obvious, being broken only by the darkened veins. The underside differs in the formation of the submarginal series of spots on the fore wing; whereas in the nominate race these spots are rounded and well separated, those of *coalescens* are elongate and tend to coalesce, giving the appearance of a continuous band.

♀. Apart from wing-shape, and some reduction in size of the apical patch on the fore wing, this sex is similar to the male.

Holotype ♂, RHODESIA: Umtali, ix. 1929 (*D. R. Sheppard*) B.M. Type No. Rh. 17218.

Paratypes. RHODESIA: Umtali, x. 1937, Jackson Coll. (allotype ♀, B.M. Type No. Rh. 17219); Odzani, x. 1938, Jackson Coll., 1 ♂ (BMNH); Rusape, ix. 1941, 1 ♂ (NMR, Bulawayo); Odzani, 17.x.1931 (*Sheppard*), 1 ♂ (NMR, Bulawayo); Odzani, 2.x.1938 (*Barnes*), 1 ♀ (NMR, Bulawayo); Mt Selinda, xi–xii. 1938 (*Stevenson*), 1 ♂ (NMR, Bulawayo); Macheke, 4.ix.1962 (*Plowes*), 6 ♂, 1 ♀ (Pl.); Headlands, 5.ix.1962 (*Plowes*), 1 ♀ (Pl.); Umtali, 9.x.1938 (*Pennington*), 1 ♀ (TM, Pretoria).

### *Aloeides molomo mumbuensis* Riley

(Pl. 1, figs 40, 41, 59, and 60)

*Aloeides molomo mumbuensis* Riley, 1921 : 250, pl. 7, figs 3–6. Holotype ♂, ZAMBIA: Mumbwa, 1.ix.1913 (*H. C. Dollman*) (BMNH) [examined].

Length of fore wing: ♂ 13–14 mm; ♀ 14–15 mm.

This race has some affinity with *molomo krooni*, but the dark borders on all wings are much wider, and the apical patch of the hind wing is much more extensive;

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* Since going to press, Dr D. M. Kroon has reported taking a series of *A. molomo krooni* at Otavi, South West Africa, on 28.xii.1971. He identified these specimens by comparison with the paratypes in the Transvaal Museum, Pretoria.

it does not however extend below vein 4. The underside colour is paler than that of the nominate race, but less so than in *krooni*.

As far as is known, this subspecies has only been found in the type-locality.

MATERIAL EXAMINED.

ZAMBIA: Mumbwa, 1.ix.1913 (*H. C. Dollman*), 4 ♂, 4 ♀ (BMNH); Mwengwa (recte Mumbwa), 1.ix.1913 (*H. C. Dollman*), 1 ♀ (BMNH).

### ***Aloeides molomo kiellandi*** Carcasson

(Pl. 1, figs 43, 44, 62, and 63)

*Aloeides molomo kiellandi* Carcasson, 1961 : 19. Holotype ♂, TANZANIA: Wanzizi, Mpanda, vii. 1959 (*J. Kielland*) (BMNH) [examined].

Length of fore wing: ♂ 16–17 mm; ♀ 18–19 mm.

♂ ♀. Differs from all other races by the great width of the distal band on the fore wing, which measures 4·5 mm at vein 2 in the male holotype, and together with the apical patch covers more than half of the wing area. A character not previously mentioned is the presence within the distal band of the fore wing of a series of five tawny orange submarginal spots, situated in areas 2, 3, 4, 5 and 6. The underside of the hind wing is pale brown with reduced dark markings, and with no indication of silver-white spotting. The darker diffuse band which is so obvious in *molomo molomo* is in this race scarcely discernable.

MATERIAL EXAMINED.

TANZANIA: Mpanda, vii. 1959 (*Kielland*), 1 ♀ (allotype) (BMNH); Mpanda, 21.ix.1967 (*Kielland*), 3 ♂ (BMNH); Mwisi, Mpanda, 5–6.viii.1970 (*Kielland*), 1 ♀ (UM, Oxford), 2 ♂ (BMNH); Sitebe, Mpanda, ix. 1970 (*Kielland*), 1 ♂ (UM, Oxford).

### ***Aloeides molomo handmani* subsp. n.**

(Pl. 1, figs 45, 46, 64, and 65)

Nearest to *A. m. kiellandi* Carcasson, but much darker below and with markings in some respects tending towards *A. m. molomo* Trimen.

Length of fore wing: ♂ 15–16 mm; ♀ 16–17 mm.

♂. The cilia are dark blackish brown above and below, much darker – especially on the hind wing – than are those of *kiellandi*, which itself has darker fringes than any of the other subspecies. The upperside of the fore wing is reddish orange with black markings much as in *kiellandi*, though the distal band is not quite so extended basad as in the holotype of that subspecies; in two males the orange postdiscal series of spots separating the black apical patch from the distal band is obliterated by black scaling. On the upper side of the hind wing, the apical patch is shaped much as in *kiellandi* and *mumbuensis*, but differs in that it extends from the costal margin to just below vein 4, so that all individuals show some kind of black scaling in area 4; two males exhibit in addition a minute spot in area 3, and black antemarginal dots fused to each other as well as to the marginal line. The underside is darker than in any other subspecies. On the fore wing, the costal, apical and marginal areas are coloured as is the hind wing. The remainder of areas 1a to 3 and narrowly along the posterior part of the cell are coloured bright orange; the spots are well developed, being black with dull silvery grey edging. Apart from a slight lightening of the submarginal area in areas 2 to 5, shown by most specimens, the hind wing surface is of an even tone, thus differing markedly from the alternate dark (basal and postdiscal) and light (discal and marginal) banded appearance of the nominate subspecies or the irregularly marked metallic spotted underside of *mumbuensis*.

♀. As well as the normal dimorphism in wing shape, this sex differs from the male as follows: on the upper side of the hind wing, the antemarginal black dots are not expanded and fused to one another; there is no sign of a brown streak closing the cell as in *kiellandi;* the underside of the hind wing is somewhat lighter, with the submarginal area distinctly lighter as in nominate *molomo*, and differing from *coalescens* in that the median and submarginal series of spots are not close together forming a single dark band, but are separated by a slightly paler area, and in that there is no paler band between the discoidal and the median series of spots.

Holotype ♂. MALAWI: near Ncheu, 28.viii.1965 (*J. D. Handman*), B.M. Type No. Rh. 17226.

Paratypes. MALAWI: near Ncheu, 28.viii.1965 (*Handman*), 1 ♀ (allotype B.M. Type No. Rh. 17227) (BMNH), 14 ♂, 4 ♀; Nr Ncheu, 20.ix.1965 (*Handman*), 6 ♂, 1 ♀; Nr Ncheu, 24.x.1963 (*Handman*), 1 ♂. (These paratypes are dispersed as follows: in addition to the allotype, 1 ♂, 1 ♀ in BMNH; 5 ♂, 2 ♀ in C. B. Cottrell Coll.; all the remainder in J. D. Handman Coll.)

This subspecies was discovered by Mr J. D. Handman, now of Oranjekrag, O.F.S., and was about to be described by Dr C. B. Cottrell. On hearing that the present paper was in preparation, Dr Cottrell most generously placed the material and a draft description of both this and *Aloeides conradsi angoniensis* (p. 248) at the disposal of the authors, with full permission to include both taxa in this work, the types to be presented to the BMNH.

The following notes are quoted from Dr Cottrell in litt.:

'Male. Expanse (mean ± S. D. 20 specimens) 31·2 ± 1·95 mm (HT. 33·2 mm.) Female. Expanse (8 specimens) 35·5 ± 0·76 mm. (AT. 35·6 mm.) Male. Antenna wing ratio (mean ± S. D., 16 specimens) 0·480 ± 0·016 mm. (HT. 0·482); Female Antenna wing ratio (5 specimens) 0·443 ± 0·017 mm.'

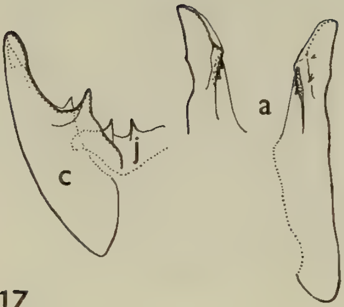
'3 males from the Vipya Plateau also captured by J. D. Handman on 19.ix.'64 are very similar to the Ncheu series but differ in that the *UpH* black costal patch not only extends to V3 but in addition is followed by a series of proximal sub-marginal black dots in A3, 2 and 1c and in that *UpH* ground colour is slightly paler. A similar male was taken (also by J. D. Handman) on the Nyika Plateau on 22.x.1967.'

## ***Aloeides barklyi*** (Trimen)

(Pl. 1, figs 48, 49, 67, and 68; Text-fig. 18)

*Zeritis barklyi* Trimen, 1874 : 338. 10 ♂, 3 ♀ syntypes, CAPE PROVINCE: Namaqualand (*Trimen*) (depository unknown).

Amplification of the characters given in the key is scarcely necessary for the ready identification of this species. Although the general appearance of the underside is characteristic of the genus as a whole, the unique light silvery grey colouring of the upperside separates it immediately from any other *Aloeides*. The superficial resemblance of the female, with its subapical orange patch in the



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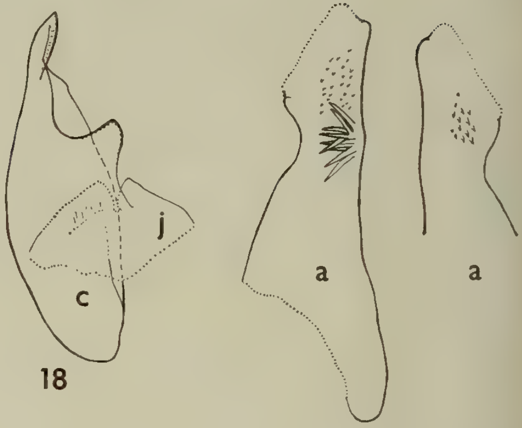

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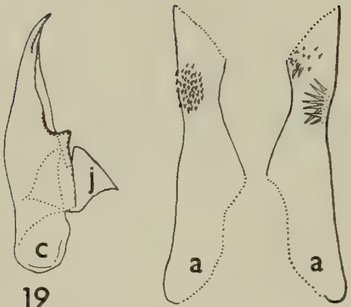

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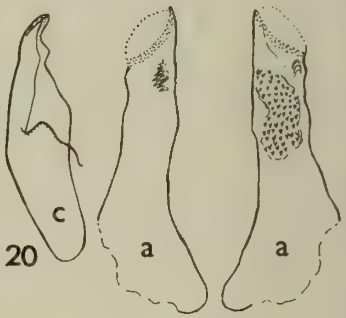

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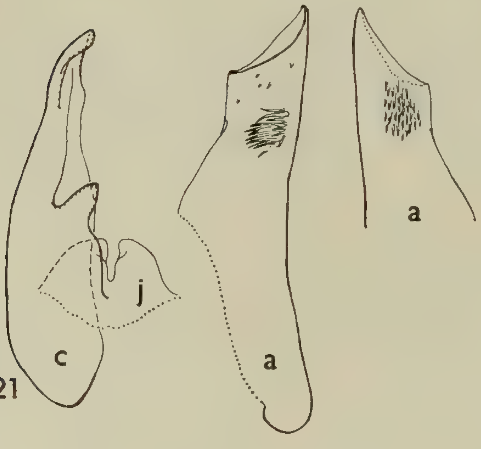

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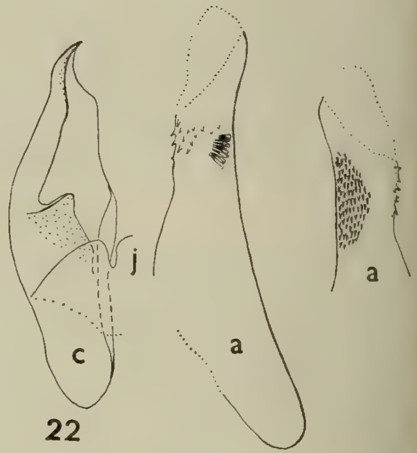

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FIGS 17–22. Male genitalia of *Aloeides*. 17, *A. molomo molomo;* 18, *A. barklyi;* 19, *A. conradsi conradsi;* 20, *A. stevensoni;* 21, *A. angolensis*; 22, *A. griseus* (j = juxta, c = clasper, a = aedeagus, in each case).

fore wing, to some Pierid species of the genera *Anthocaris* or *Teracolus* (*Colotis*) was remarked upon by Trimen himself. The distribution of *barklyi* is now known to be less restricted than when Trimen first discovered the butterfly well to the north in Little Namaqualand in August 1873. Dr P. R. D. Drysburgh has drawn attention to the fact that specimens that were found by him to the south-west of Clanwilliam differ slightly from Namaqualand examples in having a more dusky suffusion on the upperside. This also applies to a single female which was taken by Mr C. W. Wykeham between Koekenaap and Nieuwerust in September 1966. In spite of the protective nature of the underside colouring and pattern, the butterfly can be remarkably alert when settled on the ground with folded wings, and frequently rises unexpectedly when approached, to fly rapidly for a short distance before settling again.

The male genitalia are of the most usual form found in the genus, having a projection on the dorsal edge of the clasp, an aedeagus with two exterior patches of recurved hooks, a group of strong cornuti in the vesica, and a bifid juxta with rounded lobes.

MATERIAL EXAMINED.

CAPE PROVINCE: Kamieskroon, ix. 1950 (*Swanepoel*), 5 ♂, 2 ♀ (BMNH); Springbok, ix. 1950 1 ♂ (BMNH); Clanwilliam, 1 ♂ (BMNH); without definite data, 5 ♂, 2 ♀ (BMNH); Springbok, x. 1946 (*Pennington*), 1 ♂ (NMR, Bulawayo); Garies, 1500′, ix. 1938 (*R. C. Wood*), 1 ♂, 1 ♀ (UM, Oxford).

## ***Aloeides conradsi*** (Aurivillius)

This has the most northerly habitat of all the species in the genus, and it is the only representative that extends into Kenya. Slight but constant differences serve to distinguish the three subspecies, and further collecting may well produce others.

The males of all the subspecies may be readily identified by their rather narrow, sharply pointed fore wings, and by the dull grey-brown colour of the upperside, which is rarely more than feebly touched with nebulous pale straw or ochreous spots. The females are usually larger in size than those of *molomo molomo*, and their colour above is less clear in tone. The apical patch and distal band are wide, and a scattering of dark scales of individually variable intensity extends along the veins. In some cases, this scattering is very heavy, and unites to form a transverse median band on the fore wing; this character being most frequent in the subspecies *angoniensis*.

The underside is very variable both in colour, and in definition of the hind wing spotting. On the fore wing, the ground colour is tawny orange, and the white centred, black ringed spots are arranged much as in *molomo*. The costal and distal margins of the fore wing, and the entire hind wing varies individually through various shades of buff to deep pink, the spotting on the hind wing being of a deeper shade of the ground colour with lighter centres.

The male genitalia are like those of the preceding species, but are much smaller in proportion to the size of the insect. Usually there are two patches of recurved hooks on the aedeagus, the individual hooks being smaller; in occasional examples, the patch on the left-hand side of the organ is represented by only a few scattered hooks. The dorsal projection on the clasper varies individually in size, but it is always smaller and less pronounced than is that of *barklyi*.

### KEY TO THE SUBSPECIES

This key is based entirely on the upperside of the wings. The males of *A. c. talboti* and *A. c. jacksoni* cannot be distinguished on wing-pattern.

1 (1) Pale markings absent or vestigal in the male (Pl. 2, fig. 71). Female with the tawny orange areas heavily clouded with dusky scaling; distal band of the fore wing more than 3 mm wide at vein 3 (Pl. 2, fig. 72. (Malawi) **c. angoniensis** (p. 248)

– Pale markings present in the male. Female with the tawny orange areas not heavily clouded with dusky scaling; distal band of the fore wing less than 3 mm wide at vein 3 . . . . . . . . . . . 2

2 (1) Pale markings of the male straw-coloured (Pl. 1, fig. 50). Female rich tawny orange in colour (Pl. 1, fig. 51). (Ukerewe) . . . **c. conradsi** (p. 246)

– Pale markings of the male ochraceous. Female pale tawny orange in colour . 3

3 (2) Female fore wing with the dark distal margin less than 2·5 mm wide at vein 3 (Pl. 1, fig. 47). (West of Rift Valley) . . . . **c. talboti** (p. 247)

– Female fore wing with the dark distal margin more than 2·5 mm wide at vein 3 (Pl. 1, fig. 42). (East of Rift Valley) . . . . **c. jacksoni** (p. 247)

## ***Aloeides conradsi conradsi*** (Aurivillius)

(Pl. 1, figs 50, 51, 69, and 70; Text-fig. 19)

*Phasis conradsi* Aurivillius, 1907 : 3, Holotype ♀, TANZANIA: Ukerewe (depository unknown).

Length of fore wing: ♂, 15–16 mm; ♀, 15·5–19 mm.

♂. On all wings, the upperside is dull brown with pale straw-coloured markings of variable extent; these consist on the fore wing of a discoidal spot and a series of obscure submarginal spots, extending inwards as a pale washing in some examples. The hind wing bears a similar but even more diffuse submarginal series.

♀. The upperside is rich tawny orange, not so clear in tone as that of *molomo*, and with vague scattering of dark scales along the veins. On the fore wing, there is a dusky brown area at the base, a discoidal spot of the same colour, a poorly defined median band extending from the shadowy apical patch, and followed by a marginal band of approximately 2·5 mm in width at vein 3.

MATERIAL EXAMINED.

TANZANIA: Ukerewe (various collectors), 17 ♂, 18 ♀ (BMNH); Itigi, 150 miles east of Tabora, iii–iv. 1917 (*Hale-Carpenter*), 19 ♂, 16 ♀ (UM, Oxford); Old Shinyanga, 22.ii.1935 (*E. Burtt*), 1 ♂, 1 ♀ (UM, Oxford); Dodoma, 30.xii.1965 (*Kielland*), 1 ♂, 1 ♀ (BMNH); Ibwaga near Kongwa, iii–iv. 1917 (*Rogers*), 12 ♂, 18 ♀ (UM, Oxford).

### ***Aloeides conradsi talboti*** subsp. n.

(Pl. 1, figs 47 and 66)

*Phasis conradsi* ♂ f. *ochraceous* [sic] Joicey & Talbot, 1924 : 546. Holotype ♂, TANZANIA: District of Great Craters, ii-iii.1921 (*T. A. Barns*) (BMNH) [examined].

Length of fore wing: ♂ 13–15 mm; ♀ 14–17 mm.

♂. The upperside is similar to that of the nominate subspecies, but the pale markings on all wings are more extensive and, though variable in colour, are always of a more ochraceous or tawny orange tint; the submarginal series on the hind wing is especially deep in colour Form *ochraceoa* Joicey & Talbot is an extreme example, in which the tawny orange areas on all wings are so extended that the pattern is almost like that of the female.

♀. Only differs above from the nominate subspecies by its paler more yellowish ground colour.

♂ ♀. The underside is identical with that of *conradsi conradsi*.

The possibility that the name *ochraceoa* could be used for this subspecies was considered, and Article 45 of the *International Code of Zoological Nomenclature* consulted. It is well known that the authors concerned recognized the modern use of the terms species, subspecies and form; in fact all three terms appear in the paper in question. In addition, the reference to what they considered the typical *conradsi* from the Ngorongoro Crater in the same area, and the fact that only one example of *ochraceoa* was considered does indicate that the name was published as that of an infrasubspecific taxon for one sex only. It has therefore no subspecific standing. As a matter of fact, there are two female specimens in the BMNH (ex Joicey Coll.) bearing exactly similar data labels as that attached to the type of *ochraceoa*, and obviously collected with it; they do not differ in any way from females from the Ngorongoro Crater. These two insects were certainly in the Joicey collection, and it is surprising that no mention was made of them in the description of *ochraceoa*. These facts obviate the undesirable necessity of using an extreme aberration as the holotype of the subspecies.

Holotype ♂, TANZANIA: Ngorongoro Crater, Arusha District, 5,800′, ii. 1921 (*T. A. Barns*), B.M. Type No. Rh. 17222.

Paratypes. TANZANIA: data as holotype, 1 ♀ (allotype, B.M. Type No. Rh. 17223); data as holotype, 15 ♂, 6 ♀ (BMNH); District of Great Craters, ii–iii. 1921 (*Barns*), 2 ♀ (BMNH); Plateau near Mbula, Arusha District, 6,000′, iii. 1921 (*Barns*), 1 ♀ (BMNH); north end of Lake Manyara, Arusha District, ii. 1921 (*Barns*), 1 ♀ (BMNH); west shore of lake Manyara, ii–v. 1935 (*B. Cooper*), 1 ♀ (BMNH).

Material excluded from the type-series. KENYA: Upper Kuja Valley, S. Kavirondo, 4′200′, v. 1911 (*Neave*), 3 ♂, 8 ♀; Valley of Mirua, S. Kavirondo, 4,500′, v. 1911 (*Neave*), 1 ♀; S. Kavirondo, 1931–2 (*van Someren*) 3 ♂, 5 ♀; Kisumu, v. 1947 (*Jackson*), 1 ♂; Port Florence, Kisumu, iv. 1911 (*Neave*), 1 ♀ (all BMNH).

### ***Aloeides conradsi jacksoni*** subsp. n.

(Pl. 1, figs 42 and 61)

Length of fore wing: ♂ 14–17 mm; ♀ 16–20 mm.

♂. Larger in size, but otherwise very similar both above and below to that sex of the preceding subspecies.

♀. Differs from both *c. conradsi* and *c. talboti* females by its greater size, and by the much greater width of the distal band on the fore wing; in most examples this band attains a width of 4 mm at vein 3.

From the material available it is evident that *talboti* occurs to the west, and *jacksoni* to the east of the Rift Valley. The differences between these two subspecies are certainly slight, but they are very evident when a long series of each is compared.

Holotype ♂, KENYA: Nairobi, iv. 1935 (*T. H. E. Jackson*), B.M. Type No. Rh. 17224.

Paratypes. KENYA: Nairobi, iv. 1935 (*Jackson*), 1 ♀ (allotype, B.M. Type No. Rh. 17225) 5 ♂, 3 ♀; Nairobi, 1931–4 (*van Someren*), 12 ♂, 3 ♀; Nairobi, 1905, 4 ♂; Bissel, near Nairobi, 6,000′, ii. 1916 (*H. Tytler*), 4 ♂, 8 ♀; Bissel-Mamanga (*van Someren*), 1 ♀ (all BMNH); Nairobi, 5,500′, 17.x.1919 (*K. St A. Rogers*), 1 ♀; 15 miles west of Fort Hall, Kikuyu, Weithaga, 6,000′, 20.iii.1907 (*St A. Rogers*), 1 ♀ (both UM, Oxford); Kikuyu, iv. 1900 (*Crawshay*), 1 ♂, 1 ♀; Ngong, v. 1947 (*van Someren*), 1 ♂, 2 ♀; Ketiti, Ukamba, 14–16.xi.1896 (*Ansorge*), 1 ♂, 1 ♀; Teita 1 ♂, 1 ♀; Machakos, 15.iv.1898 (*Ansorge*), 1 ♀ (all BMNH); Machakos, Mukan Hills, 10–11.vi.1908 (*St A. Rogers*), 1 ♂, 2 ♀ (UM, Oxford). TANZANIA: Longido West, 1916 (*Tytler*), 1 ♂, 2 ♀; Tabora (various collectors), 3 ♂, 7 ♀ (all BMNH).

### ***Aloeides conradsi angoniensis*** **subsp. n.**

(Pl. 2, figs 71, 72, 88 and 89)

Darker and more richly coloured than the nominate subspecies; in the male with the postdiscal band on the upperside of the hind wing, when distinct, almost invariably dark orange rather than greyish yellow; in the female with the orange area of the fore wing upperside usually completely, always partly, separated by black scaling extending inwards from both the costal and inner margins into the post discal and basal orange areas.

♂. The cilia above are dark blackish brown, only narrowly and faintly interrupted by light grey between the veins, most markedly so in areas 1*b*, 2 and 3 on the fore wing. The upperside fore wing is dark blackish brown with only the faintest (usually scarcely discernible) powdering of light scales between the base of the wing and the region of the discal band; these scales tend to be orange rather than greyish yellow, and when present, are most prominent about the middle of area 1*b*. A postdiscal series of five light coloured spots is present in areas 2 to 6, those in areas 2 and 3 being longer and having a greater tendency to be orange; in thirteen specimens at least some of these spots are orange; in seventeen (including the holotype) all the developed spots are greyish yellow; in one specimen only, the spots are not visible. On the underside, the cilia are maroon tinted brown with black chequering at the vein ends. The fore wing is slightly darker than that of the nominate race, and the hind wing dark maroon tinted brown with blackish brown spots edged with dull silvery grey.

♀. The cilia above are blackish brown, chequered between the veins with orange-brown just below the apex of the fore wing, and with grey elsewhere. On the upperside of the fore wing, the black scaling which extends between the costal and inner margins is much better developed than in nominate *conradsi;* in areas 1a and 1b it extends outwards to unite with the black distal band, so that the postdiscal orange area does not approach closer to the inner margin than the interneural fold of area 1b. In six specimens (including the allotype), this black scaling extends without a break from the costa to the inner margin, thus completely cutting off a postdiscal orange band from the basal area; in the remaining three specimens, the black scaling is incomplete in area 3 (one specimen) or in areas 2 and 3 (2 specimens), so that the postdiscal orange area is not completely separated from the basal area. The underside is like that of the male, but the hind wing is of a somewhat deeper maroon colour.

Holotype ♂, MALAWI: Ncheu, 21.xi.1965 (*J. D. Handman*), B.M. Type No. Rh. 17226.

Paratypes. MALAWI: Ncheu, 21.xi.1965 (*Handman*), 1 ♀ (allotype, B.M. Type No. Rh. 17227), 22 ♂, 6 ♀; Ncheu, 14.xi.1965 (*Handman*), 1 ♂, 2 ♀; Ncheu, 25.xi.1962 (*Handman*), 4 ♂; Ncheu, 26.xi.1962 (*Handman*), 1 ♂; Ncheu, 27.xii.1964 (*Handman*), 2 ♂ (7 ♂, 3 ♀ in C. B. Cottrell Coll.; all the remainder in J. D. Handman Coll.); Ncheu, 14–21.xi.1965 (*Handman*), 1 ♂, 1 ♀ (BMNH).

Material excluded from the type-series. ZAMBIA: Isoka, 2.xii.1952 (*C. B. Cottrell*), 2 ♂; Lusaka, 9.x.1955 (*J. A. Cottrell*), 2 ♂; Hills 69 miles from Lusaka on Fort Jameson Road, 27.xi.1963 (*C. B. Cottrell*), 1 ♀. TANZANIA: Mpanda District, vii–viii. 1970 (*J. Kielland*), 17 ♂, 9 ♀ (BMNH); 3 ♂, 3 ♀ (UM, Oxford).

The following notes are quoted from C. B. Cottrell (*in litt.*):

'Male expanse (mean ± S.D. 31 specimens) 33·3 ± 1·72 mm (holotype 35·6), Antenna – wing ratio (20 specimens) 0·476 ± 0·011 (holotype 0·483). Female expanse (9 specimens) 35·0 ± 2·85 mm (allotype 38·8 mm). Antenna wing ratio (7 specimens) 0·458 ± 0·019 (allotype 0·443).'

### *Aloeides angolensis* sp. n.

(Pl. 2, figs 74, 83, 91 and 100)

Length of fore wing: ♂ 16–17 mm; ♀ 14–16 mm.

♂. Larger than that sex of *damarensis*, the apex of the fore wing far more acute, and the distal margin is straighter. The head and frons are ferrugineous; the palpi are smooth, and of the usual *Aloeides* type. The fore wing is dingy fuscous with an ochreous tinge, and is margined distally by a wide – over 2 mm – dusky brown band, which widens to twice its width at the anal angle. A dark margined pale spot closes the cell. In the disc, a series of dusky median spots – four in number – are placed in areas 2, 3, 4 and 5, that in 4 being well distad of those in 3 and 5; they are immediately above their counterparts on the underside, but are in fact definite dark patches and not the result of the underside spots showing through. This character has not been observed in any other member of the genus. The hind wing is coloured as the fore wing, but is brightened with some ochreous scales distally, and is margined by a series of dusky submarginal lunules. The cilia are pale fuscous chequered at the vein ends with rufous and dusky scales. In one example, a clear yellow-orange area occurs on the fore wing, situated between the median series and the distal margin, extending between vein 2 and vein 5. A similar wider area extends from the anal angle to vein 5 on the hind wing.

♀. Apart from wing-shape this sex is very similar to the male; one example exhibits obscure indications of orange areas on the wings as in the aberrant male.

♂ ♀ underside. On the fore wing, all the usual spots are present; those of submarginal series are reduced regularly in size from the anal angle to the apex, those nearest the costa tending to obsolescence. The spots in the cell and the median series are large, heavily ringed with black, and have intensely white centres. The ground colour is pale orange-yellow, the apex and distal margin being buff-brown, or in some individuals reddish buff-brown. On the hind wing, the colour matches that of the apex and margin of the fore wing; the pale spots are just lighter shade of the same colour, and are finely ringed with darker brown. These spots are positioned much as are those of *damarensis*, but unlike that species they never exhibit a metallic lustre.

The male genitalia are in all respects like those of *damarensis* and the taxon may prove to be a subspecies of that species when more information is available.

Holotype ♂, ANGOLA: Benguella, 26.ix.1904 (*Dr Ansorge*), B.M. Type No. Rh. 17228.

Paratypes. ANGOLA: data as holotype, 1 ♀ (allotype, B.M. Type No. Rh. 17229), 2 ♂, 1 ♀ (BMNH).

### *Aloeides stevensoni* sp. n.

(Pl. 3, figs 108 and 125; Text-fig. 20)

[*Phasis taikosama* (Wallengren); Stevenson, 1957 : pl. 1, fig. 3. Misidentification.]

Through the kindness of Dr Elliot Pinhey and the authorities of the National Museum, Bulawayo, the only known examples of this species were received on loan, together with a number of *Aloeides trimeni* (*taikosama* auct. nec Wallengren) from Inyanga. It was at once apparent that the two specimens concerned were abundantly different from both *trimeni*, and all other species in the genus; their distinctive wing shape, the velvety appearance of their ferrugineus brown wings, and genitalic characters all serve to confirm that view. Stevenson's photographic figure is evidently taken from one of these specimens.

Length of fore wing: ♂ 12 mm.

♂. The fore wing costa is strongly arched, the apex rather obtuse, and the distal margin strongly convex. The rounded hind wing is scarcely produced at all at the tornus. On the upperside, deeper and richer in colour than in *trimeni*, it is deep dark brown with a tinge of ferrugineus; the surface is dense in texture, giving the impression of a velvety appearance. The fore wing is entirely without markings, and on the hind wing the ground colour is only broken by a vague patch of tawny orange scales near the tornus, and a sparse scattering of similar scales in areas 1, 2 and 3. The fringes are grey-buff, without any obvious chequering at the vein ends. On the underside, the pattern is similar to that of *trimeni*, but the colour is deeper, and on the fore wing, the white centred black spots in the cell and median series are rather larger. The spots in the submarginal series are large and well formed, diminishing in size towards the apex. The costal and distal marginal areas are dingy fuscous. On the dingy fuscous hind wing, the median series is only visible as a chain of interneural linear black marks, those in areas 1, 2 and 3 being placed nearer to the base of the wing than are their counterparts in *trimeni*, giving a distinctly rounded appearance to the series as a whole. The usual basal and submarginal series of spots are present, they are blackish, but not strikingly evident. A noticeable rufous brown patch occupies parts of areas 4, 5 and 6 in the subapical region, and a smaller though similar patch is placed near the tornus.

♂ genitalia. All parts are slightly smaller than those of *trimeni;* the aedeagus is without a patch of recurved hooks on the left hand side, but is furnished with a large patch of rather small hooks on the right. In contrast, *trimeni* has a definite patch of hooks on the left, and a patch of fewer but larger hooks on the right.

♀. Unknown.

Holotype ♂, RHODESIA: Rusape, vi. 1926 (*R. H. R. Stevenson*) (NMR, Bulawayo).
Paratype. RHODESIA: data as holotype, 1 ♂ (BMNH).

### ***Aloeides griseus*** Riley

(Pl. 2, figs 75, 76, 92 and 93; Text-fig. 22)

*Aloeides griseus* Riley, 1921 : 251, pl. 7, figs 1, 2. Holotype ♂, ZAMBIA: Solwezi, 22.viii.1917 (*H. C. Dollman*) (BMNH) [examined].

Length of fore wing: ♂ 15–18 mm; ♀ 18–19 mm.

♂. The upperside of all wings is dark grey-brown, with faint golden reflections in certain lights. There is an obscure lighter grey spot at the cell-end of the fore wing, and a barely indicated series of submarginal lunules of similar colour on the hind wing. The fringes are pale grey with darker chequering at the vein ends.

♀. Above, very like the male, but the fore wing exhibits a cloudy submarginal band, light grey in colour, and extending from area 2 to the near vicinty of the costa. The light grey submarginal series of lunules on the hind wing is much more clearly defined.

♂ ♀. Unlike all other members of the genus, the underside ground colour of the fore wing is not tawny orange; it is in fact pale grey with a distinct yellow tinge, on which the black ringed white centred spots stand out clearly. The costal and distal margins are greyish, the submarginal series being but faintly indicated. On the hind wing the colour is grey, the brownish ringed spots not being strongly in contrast with the ground, and the submarginal series is but faintly indicated.

♂ genitalia. The clasper is larger by one third than that of *taikosama*. The aedeagus has few and scattered hooks on the left-hand side, but a large patch of small closely placed recurved hooks on the right.

At first sight this species has the appearance of a large dark male of *taikosama*, but it can be readily distinguished by the greyish (not orange) colour of the fore wing beneath. Dr C. B. Cottrell (*in litt.*) writing of this insect says 'I have taken this on virtually every spring and early summer visit to the Nyika since 1952. When out it is abundant there. There is a good deal of variation in size, and in the presence of the light greyish-yellow markings above in both males and females, but after carefully comparing Nyika specimens with Dollman's types, I don't think the two are worth separating'.

MATERIAL EXAMINED.

ZAMBIA: Solwezi, 22.viii.1917 (*Dollman*), 1 ♀ (allotype) (BMNH). MALAWI: Nyika Plateau, 7,000′, 16–17.ix.1964 (*J. D. Handman*), 1 ♂, 1 ♀ (BMNH).

### ***Aloeides taikosama*** (Wallengren) **comb. n.**

(Pl. 2, figs 77, 78, 94 and 95; Text-fig. 23)

*Cygaritis taikosama* Wallengren, 1957 : 43. Holotype ♀, Caffraria (NR, Stockholm) [examined].

*Zeritis orthrus* Trimen, 1874 : 340, pl. 2, fig. 10, Natal (depository of type unknown). **Syn. n.**

This species has long been known to collectors as *orthrus* Trimen, and the name *taikosama* Wallengren has been used for the species now to be named *trimeni* (p. 260). Through the kind co-operation of Dr Per Inge Persson of the Stockholm Museum, both authors have been enabled to examine the holotype of Wallengren's *Cygaritis taikosama*, and there can be no doubt that it is a female example of the species now under discussion. The necessity of making the change in the long established usage of the name is much regretted. The insect exhibits a wide range of individual variation, but in the large series examined, upwards of two hundred examples, and coming from widely different localities, there is no visible evidence of subspeciation. It inhabits a wide area extending over Natal, Transvaal, Mozambique, Rhodesia and Zambia.

Length of fore wing: ♂ 11–16 mm; ♀ 14–18 mm.

♂ upperside. As in *griseus*, but on the fore wing there is a curved submarginal series of interneural straw-grey blotches, extending from area 2 to near the costa; this series varies in size and definition in different individuals, but is frequently more obvious than the corresponding series in female *griseus*. The submarginal series of straw-grey lunules on the hind wing is in most examples sharply delineated, although specimens do occur in which this series is vestigial or absent altogether. The light grey fringes are rather more definitely chequered than are those of the previous species.

♀ upperside. Dingy brown, of a warmer tone than that of the male, the submarginal series is run together to form an irregular band of varying extent, often with ray-like extensions towards the distal margin, and always of a bright tawny orange colour; in very few examples indeed is this tawny orange band absent. The fringes are like those of the male.

♂ ♀ underside. The fore wing is mainly tawny orange, the silver-white black ringed spotting being very obvious. The hind wing varies in individuals from pale grey-brown to warm reddish brown; the spots are deeper in tone than the ground, and have whitish centres with more or less metallic lustre in certain lights.

♂ genitalia. Very similar to those of *griseus*, but only two-thirds the size.

The butterfly has a wide variety of habitats, some of them in the Karroo, others in grassland or savannah country, or even in the subtropical coastal belt as at Laurenço Marques. The colouring of the underside can vary greatly even in examples from the same locality, some individuals being of a full maroon colour, in contrast to the dull brownish tone of others. In the Great Karroo, the species has been found in the vicinity of Beaufort West in midsummer. It appears to be absent from the country near Cape Town.

### ***Aloeides plowesi*** **sp. n.**

(Pl. 2, figs 79, 80, 96 and 97; Text-fig. 24)

Similar in appearance and closely related to *Aloeides taikosama*, this species must frequently have been passed over as *taikosama*; however, it is by no means certain that the two species do in fact fly together, even when both occur in the same district. Dr Cottrell (*in litt.*) points out that there are specimens of *plowesi* labelled as having been taken at Salisbury in both the Bulawayo and the British Museum (Nat. Hist.), yet his own entire series from that place are definitely all *taikosama*. He suggests that there may be a habitat difference, and speaking of his series says 'these specimens come almost entirely from a colony in the grounds of the University College and since I used often to stop and watch the insects on my way to and from work, I feel pretty sure that *plowesi* really was absent'.

Length of fore wing: ♂ 13–15 mm; ♀ 15–17 mm.

♂ upperside. Confusingly like that of *taikosama*, but differs as follows: the pale submarginal blotch nearest the costa is always present, and is placed slightly distad so that the otherwise convex line of the submarginal series appears to turn towards the apex as it nears the costa. The hind wing does not differ from that of *taikosama*.

♀ upperside. On the fore wing, the tawny orange submarginal series is arranged like that of the male, the costal spot being turned outwards towards the costa; the series consists of larger spots, those in areas 2 and 3 extending inwards in some examples. These submarginal spots never extend outwards towards the margin as is frequently the case in many examples of *taikosama*. On all wings the extent of these tawny orange spots is exceedingly variable.

♂♀ underside. As in *taikosama*, but far more striking; all the spotting is heavier and the colouring richer, giving an altogether more decorative appearance. The black-ringed silver-white-centred spots on the fore wing are large and prominent; the two lower spots of the median series, situated in area 1, are arranged perpendicularly and well inwards of those in areas 2 and 3, never forming a straight diagonal line with them as is frequently the case in *taikosama*. The seventh spot of the series – that nearest the costa – is always placed slightly distad, thus giving the same apical twist as is to be seen on the upperside. On the hind wing, the ground colour is fuscous, laved with reddish brown, the latter colour being especially concentrated near the distal margin and inwards of the submarginal series. The spots of the basal, discoidal and median series are strongly emphasised, brown-ringed and silver-centred; the submarginal series is also heavily marked.

The species is named after Mr D. C. H. Plowes of Umtali as some recognition of his willing aid and advice.

Holotype ♂, RHODESIA: Salisbury, 5.x.1894 (*G. A. K. Marshall*), B.M. Type No. Rh. 17231.

Paratypes. RHODESIA: Salisbury, 2.x.1894 (*Marshall*), 1 ♀ (allotype, B.M. Type No. Rh. 17232); Salisbury, viii–x. 1894 (*Marshall*), 3 ♂ (BMNH); Umchiki River, Mashonaland, 7.xi.1897 (*Marshall*), 1 ♀ (BMNH); Chimanimani, 6.v.1947 (*B. D. Barnes*), 1 ♂ (NMR, Bulawayo); Chimanimani, 12.x.1952 (*K. M. Pennington*), 1 ♂ (TM, Pretoria); Chimanimani, 23.x.1960 (*Plowes*), 6 ♂ (Pl.); Inyanga, 9–17.x.1945 (*Barnes*), 2 ♂, 1 ♀ (NMR, Bulawayo); Inyanga, x. 1945 (R. C. Cox Coll), 2 ♂ 1 ♀ (NMR, Bulawayo); Inyanga, 5.x.1958 (*H. Cookson*), 2 ♀ (NMR, Bulawayo); Inyanga, 1962–1968 (*Plowes*), 15 ♂, 12 ♀ (Pl.); Rusape, vi. 1927 (*R. H. R. Stevenson*), 1 ♀ (NMR, Bulawayo); Adam's Ridge, Melsetter, 18.xi.1965 (*Plowes*), 1 ♂ (Pl.); Beaconsfield, Estcourt, 4,000′, 19.xi.1949 (*Plowes*), 1 ♂ (Pl.); Umvukwo Hills, 10.v.1962 (*Plowes*), 1 ♂ (Pl.).

### ***Aloeides susanae* sp. n.**

(Pl. 2, figs 81, 82, 98 and 99; Text-fig. 25)

This species differs from *Aloeides trimeni* by its more convex distal margin, and rounder apex on the fore wing. As mentioned in the key, the presence of long ribbon-like scales on the second joint of the labial palpi is probably the best means of identification.

Length of fore wing: ♂ 11–15 mm; ♀ 12–15 mm.

♂ upperside. Very variable, the pattern varying from completely dark brown examples to those with quite extensive areas of tawny orange on all wings; in the most extreme examples, the tawny orange covers the basal two-thirds of areas 1, 2 and 3, and extends over the median vein and vein 4, infringing a short way into the cell and area 4. The hind wing varies in a similar manner, the lightest specimen being mainly tawny orange in areas 1 to 3, and the lower part of the cell, this area being only bounded distally by the dark margin and its contigous submarginal series of blackish spots, and basally by some dusky brown scaling. The remainder of the wing to the costa is dusky brown. On all wings, the fringes are dingy fuscous.

♂ underside. On the fore wing the ground colour is tawny orange, the spots well defined but smaller than those of *trimeni*. The double spot in area 1 is usually situated well inward of the spots in areas 2 and 3. The costal, and distal margins and the fringes are all of matching colour with that of the hind wing, which is dusky buff-brown, often tinged with reddish. The usual spot pattern is present on the hind wing, but as on the fore wing the spots are rather small; the spot-centres are greyish, and show no indication of a metallic lustre such as may be seen in many examples of *trimeni* and *damarensis*.

♀. Apart from wing-shape, this sex scarcely differs from the male on either surface, but entirely dark brown uppersides are rare.

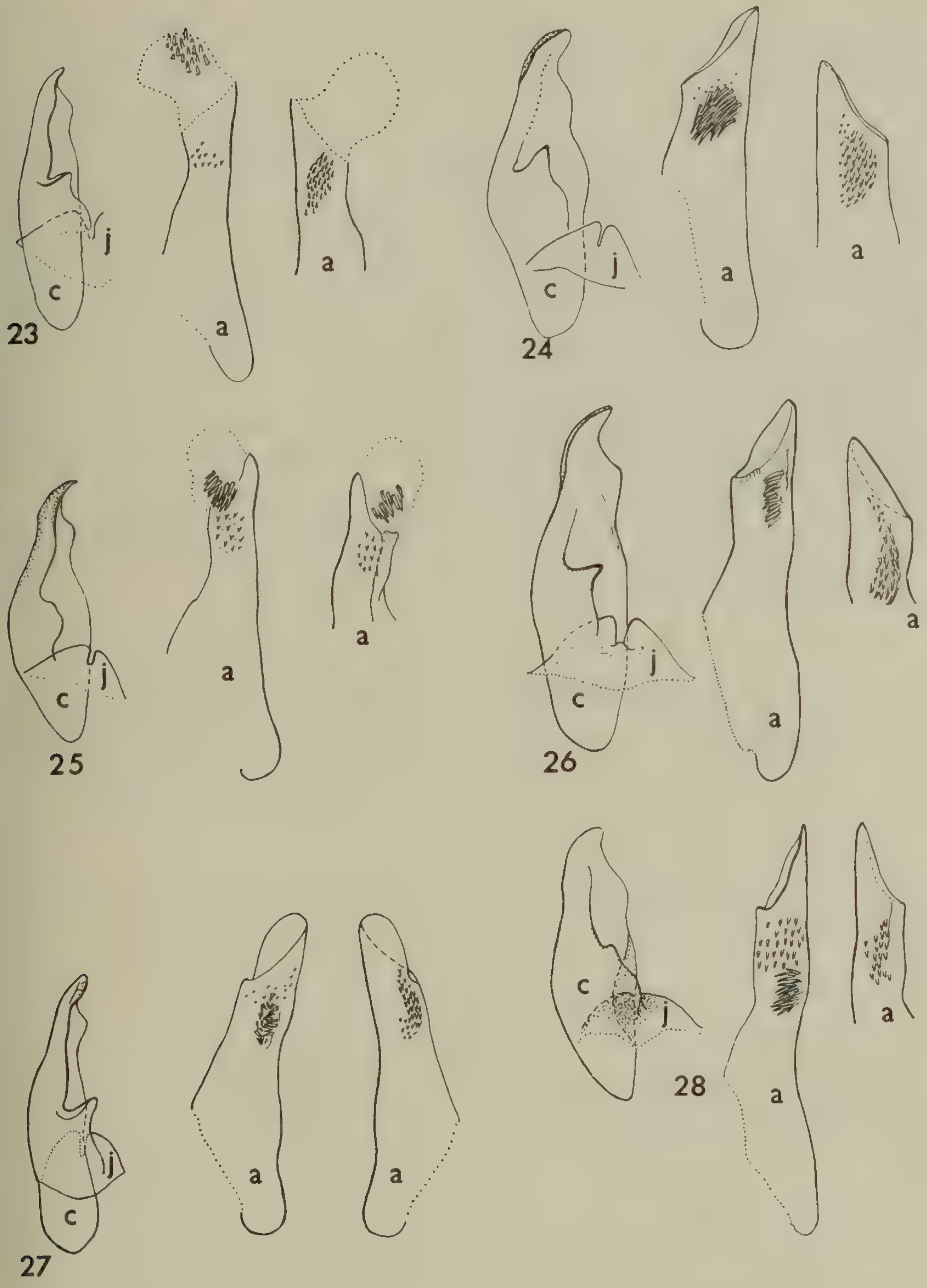
♂ genitalia. The clasp is smaller than that of *trimeni* and has the dorsal projection reduced to nothing more than an obtuse angle. The aedeagus is short and stout with well developed patches of recurved hooks, one on the left, the other on the right side.

Specimens were met with a good many years ago in Natal and in East Griqualand, i.e. north of Greytown on the 11th December, 1952, in the first instance; on the grassy slopes of Mt Marwaga (at an altitude of some 5,500 feet), Bulwer, when this mountain was being climbed in company with Mr T. W. Schofield; and in East Griqualand at the road-side in a flat stretch of country between Pietmaritzburg and Kokstad. This small insect did not answer to any of the *Aloeides* species known at that time, and it is recalled that Mr Pennington himself commented upon this fact, and on the difficulty of insects of this nature. The butterfly does not differ in its habits from the related species of *Aloeides*; it is a gregarious species, and habitually alights on the ground or at times on short vegetation, where it rests with its wings closed and is not easily noticed. (C.G.C.D.)

The species is named after Miss Susan J. May, lately on the staff of the BMNH, whose conscientious work has contributed to the completion of this paper.

Holotype ♂, NATAL: Muden, 7.i.1949 (*H. Cookson*), B.M. Type No. Rh. 17233.

Paratypes. NATAL: Muden, 12.i.1949 (*Cookson*), 1 ♀ (allotype, B.M. Type No. Rh. 17234); Muden, 1948–1949 (*Cookson*), 7 ♂, 8 ♀ (BMNH); Muden, x–xii.1951 (*Cookson*), 8 ♂, 4 ♀ (TM, Pretoria); Karkloof, ex Trimen Coll., 1 ♂ (BMNH); Karkloof, 17.x.1951 (*Cookson*), 1 ♂ (TM, Pretoria); Balgowan, 1934–1935 (*R. C. Wood*), 1 ♂, 1 ♀ (NMR, Bulawayo); Balgowan (*Pennington*), 3 ♂ (Penn.); Balgowan, 28.x.1935 (*Pennington*), 1 ♂ (TM, Pretoria); Balgowan, 17.xii.1963 (*Plowes*), 1 ♂ (Pl.); Greytown Hills, 1953–1954 (*Cookson*), 2 ♂, 3 ♀ (TM, Pretoria).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FIGS 23–28. Male genitalia of *Aloeides*. 23, *A. taikosama*; 24, *A. plowesi*; 25, *A. susanae*; 26, *A. damarensis damarensis*; 27, *A. trimeni trimeni*; 28, *A. aranda* (j = juxta, c = clasper, a = aedeagus in each case).

### ***Aloeides damarensis*** (Trimen)

This species occurs in many localities scattered over most of Southern Africa; it is found in South West Africa, Botswana, Rhodesia, Mozambique, Transvaal, Natal and Cape Province. There is some degree of geographical variation, but this is most difficult to define owing to the great degree of individual variation. Examination of some 230 specimens indicates that the general trend is for the South West African and Namaqualand specimens to be pale in colour and but weakly marked marginally with brown; Cape Province specimens on the whole are deeper tawny orange in colour with wider dusky brown margins, although some individuals do occur that are not distinguishable from South West African examples. The dusky brown marginal markings attain their greatest development in examples from Rhodesia and Mozambique, but in Botswana and Northern Transvaal a very mixed population exists, containing extremes of both light and dark forms, and intergradations between them. The existence of such a mixed population does not preclude the treatment of the more homogeneous population of Rhodesia and Mozambique as a subspecies.

♂ genitalia. These organs are very similar in size and appearance to those of *Aloeides pierus*; they can be distinguished by the more produced and more pointed projection on the dorsal edge of the valves.

### ***Aloeides damarensis damarensis*** (Trimen)

(Pl. 2, figs 84, 85, 101 and 102; Pl. 3, figs 105–107, 122–124; Text-fig. 26)

*Zeritis damarensis* Trimen, 1891 : 90. Holotype ♂, SOUTH WEST AFRICA: Omaramba Omatako, i. 1888 (*A. W. Eriksson*) (depository unknown).
*Zeritis molomo* var. A Trimen, 1887 : 206, Griqualand West.
*Zeritis damarensis* var. Trimen, 1904 : 240, pl. 19, figs 5, 5a & 5b, Kimberley.
*Phasis damarensis* ab. *punctata* Aurivillius, 1924 : 427, Kimberley.
*Aloeides damarensis* (Trimen) Clark & Dickson, 1971 : 232–233, pl. 108, figs 1, 1a–5. [Life history.]

Length of fore wing; ♂ 14–18 mm; ♀ 16–20 mm.

Compared with *A. molomo*, both sexes are paler in colour on both upper and under surfaces, and are on the whole larger. Trimen described *damarensis* from three male examples from Omaramba Omatako, Damaraland, collected by A. W. Eriksson, and stated that they represented the same species as that he described – in both sexes – as *A. molomo* var A. (1887), coming from Griqualand West. None of these original specimens are in the BMNH. His first reference to the female under the name *damarensis* was to the example he described and figured as *damarensis* var. (1904); this insect is in the BMNH and it bears a label 'Namaqualand, O'okiep (*R. Lightfoot*) 7.x.1890.' It is an average example of the sex from the South West Africa–Namaqualand area; it has the distal band of the fore wing reduced to a series of conjoined interneural, wedge-shaped spots, and the apical patch reduced to a roughly quadrangular spot, situated beyond the end of the cell. It does not appear to differ materially from Trimen's description of his so-called *molomo* var. A ♀. Populations exist in some areas which suggest that they may represent localized minor races, but owing to the general similarity in the males, and the great diversity of individual variation in the females, it has not been found possible to define them. A series from Cradock in the BMNH contains two quite distinct forms of females: one usually large in size is of the typical Namaqualand form, pale in colour with reduced markings; the other is smaller, deeper in colour, and altogether more heavily marked, having on the fore wing a wide dusky brown distal band, and an apical patch very like that of the male. Aurivillius gave the name ab. *punctata* to Trimen's *damerensis* var. (1904 : pl. 19, fig. 5b), and his description agrees well with this figure. The sex is not mentioned, but the name can only be applied to the extreme female form, having on the fore wing the apical patch entirely absent, the distal band reduced to a series of interneural spots, and without a dusky brown apical patch on the hind wing. The original of Trimen's figure is in the BMNH, and other of Trimen's specimens from the same locality (Kimberley) are in the South African Museum, Cape Town, all are of the same form.

This species flies in much of the Karroo, and in other portions of Southern Africa, including some of the desert-like tracts with sandy ground, as well as in grasslands. In a northerly direction from Cape Town, its habitats have been found to commence at Koekenaap, and near Clanwilliam, although it may possibly occur somewhat further South. Specimens normally settle on the ground with the wings closed (as in the case with other *Aloeides* species) and are inconspicuous against the similarly coloured background. There is much variation in the size of specimens, the smaller examples presumably having developed under particularly dry conditions. A species of *Aspalathus* was used by Gowan Clark when partially rearing a larva from the egg. (C.G.C.D.)

MATERIAL EXAMINED.

SOUTH WEST AFRICA: Okahandja, 27.i–2.ii.1922 (*R. E. Turner*), 2 ♂, 4 ♀ (BMNH); 'Tropical S.W. Africa (*A. W. Eriksson*) ex Trimen Coll.', 1 ♀ (BMNH); Aus, 16.ix.1950 (*G. van Son*), 1 ♂, 2 ♀ (TM, Pretoria). CAPE PROVINCE: O'okiep, ex Trimen Coll., 2 ♂, 2 ♀ (BMNH); Spectakel, ex Trimen Coll., 1 ♂, 1 ♀ (BMNH); Springbok, ex Trimen, 1 ♂, 1 ♀ (BMNH); Springbok, 2.x.1955 (*H. Cookson*), 6 ♂, 1 ♀ (TM, Pretoria); Kamieskroon, 16.xi.1948 (*G. van Son*), 1 ♀ (TM, Pretoria); Kuruman, xi. 1923, ex Cator Coll., 2 ♂, 3 ♀ (BMNH); Kuruman, i. 1956 (*C. D. Quickelberge*), 1 ♂ (Q); Maritzani, 4.xii.1920, ex Cator Coll., 1 ♀ (BMNH); Twee Rivieren, ii. 1956 (*Kalahari-Gemsbok Park Exp.*), 1 ♂, 5 ♀ (TM, Pretoria); Twee Riviere, 20.v.1956 (*H. K. Munro*), 1 ♂, 1 ♀ (TM, Pretoria); Cradock, (*Clark & Dickson*), 3 ♂, 12 ♀ (BMNH); Teebus, 5.x.1967 (*Mrs R. E. Southey*), 3 ♂, 3 ♀ (BMNH); Eastpoort, x. 1967 (*J. C. McMaster*), 5 ♂, 2 ♀ (McM); Cradock, Prince Albert, Matjesfontein, Kendrew, Naudes Pass, Beaufort West, Calitzdorp, Klippaat, Oudtshoorn, Aberdeen Distr., Steynsburg, Oudepoort, Ondekloof, Kliphoek and Teebus (various collectors and dates), 22 ♂, 14 ♀ (TM, Pretoria). NATAL: 10–12.xi.1968 (*Potgeiter & Jones*), 1 ♂ (TM, Pretoria). TRANSVAAL:

Pretoria, 15.ii.1907 (*Swierstra*), 2 ♂, 1 ♀, 21.iv.1916, 1 ♀ (TM, Pretoria); Pretoria, 23.iii.1917 (*W. Impey*), 2 ♂, 1 ♀ (TM, Pretoria); N.E. Zoutpansberg Distr., vii–viii. 1916 (*H. G. Breyer*), 2 ♂, 1 ♀ (TM, Pretoria); Olifant's Camp, 17.xi.1961 (*Vari & Rorke*), 1 ♂ (TM, Pretoria); Rooiberg, i–ii. 1912, 4 ♂, 4 ♀ (TM, Pretoria); Great Salt Pan, 15.v.1953 (*R. Badham*), 2 ♀ (TM, Pretoria). BOTSWANA: Ghanzi, 1924–1926 (*J. Maurice*), 1 ♂, 3 ♀ (BMNH); Botletle River, 1 ♀ (NMR, Bulawayo); Mahalapye, 8.iv.1954 (*Pennington*), 1 ♂ (Penn.); Mahalapye, iv. 1954 (*Cookson*), 1 ♂, 1 ♀ (TM, Pretoria); Nkate, Makarikari, viii. 1930 (*V.-L. Kal. Exp.*), 2 ♂, 1 ♀ (TM, Pretoria); Damara Pan, iv. 1930 (*V.-L. Kal. Exp.*), 1 ♂, 1 ♀ (TM, Pretoria); Metsimaklaba, III.1930 (*V.-L. Kal. Exp.*), 1 ♂ (TM, Pretoria); Lobatsi, 2.x.1957 (*Cookson*), 1 ♀ (TM, Pretoria).

## ***Aloeides damarensis mashona*** **subsp. n.**

(Pl. 2, figs 86, 87, 103 and 104)

♂ upperside. Like the nominate *damarensis*, but differs in the much greater extent of the dusky brown areas on all wings. The fore wing has a dusky brown area at the base, which extends to approximately half of areas 1, 2 and 3; above vein 3 it unites with the lower edge of the apical patch, which in turn is partially separated from the distal band by a finger of the tawny orange ground in areas 5, 6 and 7. There is a pale (almost white) spot at the cell-end. On the hind wing, the dusky brown area extends from the base over the entire costa as far as vein 6, its outer edge being angled inwardly and terminating at a point mid-way on vein 1. The remainder of the wing is tawny orange, bordered by the continuous marginal lunules to which is attached a series of five submarginal dusky spots.

♀ upperside. Darkened at the base of the fore wing, but less so than in the male. The apical patch is large and irregular in shape and is only joined to the distal band by a narrow bar at the costa. The distal band is wide, but in most examples is broken into interneural wedge shaped spots in areas 2, 3 and 4. The remainder of the wing is tawny orange. The hind wing is basically like that of the male, but the dusky brown basal area does not quite reach vein 6, and the submarginal spots – usually seven in number – are completely free from the distal lunules.

♂ ♀ underside. The pattern does not differ materially from that of the nominate race.

In parts of Botswana and Northern Transvaal there is something of a cline, specimens that could be assigned to *mashona* occurring together with examples of nominate *damarensis*, and some intermediates. The Rhodesian and Mozambique populations – although varying individually – do form a sufficiently homogeneous group to render the naming of this subspecies desirable.

Holotype ♂, RHODESIA: Bulawayo, 8.xii.1928 (Dr Cator Coll.), B.M. Type No. Rh. 17235.

Paratypes. RHODESIA: Salisbury, 5.xii.1897 (*G. A. K. Marshall*), 1 ♀ (allotype, B.M. Type No. Rh. 17236); Salisbury, 11.ix.1962 (*Plowes*), 1 ♂ (Pl.); Bulawayo, 22.ii.1927 (*Stevenson*), 1 ♂ (NMR, Bulawayo); Mt Selinda, xi–xii. 1930 (*Stevenson*), 1 ♂ (NMR, Bulawayo); Sabi Valley, 1.v.1945 (*Mr & Mrs B. C. Cox*), 1 ♂, 1 ♀ (NMR, Bulawayo); Sabi Valley, 28.i.1961 (*Plowes*), 1 ♂ (Pl.); Sabi, Lundi R. Junction, 5.iii.1968 (*Plowes*), 4 ♂, 2 ♀ (Pl.); Nyamandhlovu, 22.i.1956 (*Plowes*), 1 ♂ (Pl.); Nyamandhlovu, 2.ii.1962 (*Plowes*), 1 ♂ (Pl.); Birchenough Bridge, Sabi R., 6.vi.1960 (*Plowes*), 3 ♂ (Pl.); Niangadzi, Sabi Valley, 12.i.1959 (*Plowes*), 1 ♂ (Pl.); Gwanda District, 24.i.1956 (*Plowes*), 1 ♀ (Pl.). MOZAMBIQUE: Delagoa Bay (various collectors), 9 ♂, 8 ♀ (BMNH).

### **Aloeides pierus** (Cramer)

(Pl. 3, figs 110–112 and 127–129; Text-fig. 29)

*Papilio pierus* Cramer, 1779 : 84, pl. 243, figs E, F. (Depository of type unknown.)
*Zeritis pierus* (Cramer) Trimen, 1887 : 202.
*Aloeides pierus* (Cramer) Clark & Dickson, 1971 : 228–229, pl. 106, figs 1–24.

This species is readily identified by the characters given in the key, and by reference to the plates; it is individually variable, but has not produced any definite geographic races.

♂ upperside. Varies from examples having only vague indications of tawny orange lunules in areas 1 to 3 of the hind wing to specimens in which there are quite large areas of that colour in the outer halves of both fore and hind wings, these orange areas being divided by the darkened veins. The fringes are greyish, chequered at the vein-ends with dark brown.

♀ upperside. As in the male, this sex exhibits a great degree of individual variation in the extent of the tawny orange areas on all wings; apart from wing shape, many examples bear a great resemblance to the darker form of the male, being dusky brown with a relatively small area of tawny orange in the discal area of each wing; in others, these areas tend to increase in size, so that in more extreme cases, the main ground colour is tawny orange heavily darkened with dusky scales on the veins, and in the basal area. On the fore wing in such specimens, the distal band is very wide, and is extended inward in area 1 to approximately twice its width; the apical patch is large and triangular, but is united with the distal band only narrowly at the costa, being otherwise separated by a finger-like intrusion of the orange ground colour. A shadowy scattering of dusky scales extends between the lower edge of the apical patch and the extended portion of the distal band. In the hind wing the costal region is dusky brown to the apex, to part of area 4, and including the cell. The discal lunules are large and triangular. The fringes are chequered as in the male.

♂♀ underside. The pattern is variable, individuals occurring in which the greys and browns of the hind wing are replaced by a rich crimson. As mentioned in the key, the distinct break in the median series of spots at vein 4 is the most consistent and distinctive character.

♂ genitalia. These organs are very like those of *damarensis;* they differ in that the prominence on the dorsal edge of the clasper is much less produced, appearing in many preparations as a roughly rectangular outgrowth, whereas that of the species mentioned has an almost thumb-like appearance. The aedeagus is furnished with two well developed patches of recurved hooks.

This insect is one of the most common and widely distributed members of the group in southern Africa. It occurs in different types of floral regions, including portions of the Karroo, and varies much individually in all its habitats. Distinguishable by its characteristic form of marking on the underside of the hind wings, it is found from the coastal areas of the Western Cape to inland regions of considerable altitude, and is often encountered in large numbers, in colonies, or more generally distributed over the veld or mountain side on which the food-plants are present. Like the allied species, it habitually settles on the ground, after its quick, short flights. Oviposition has been observed at the base of an *Aspalathus* plant, and the species has been reared successfully on plants of this genus.

The pupa has been found under a stone in or near an ants' nest; however, the larva is known to be phytophagous, and is presumably only attended by ants even under natural conditions. (C.G.C.D.)

MATERIAL EXAMINED (assembled from all the collections mentioned on p. 229).

CAPE PROVINCE: Cape Town, 39 ♂, 32 ♀; Llandudno, 1 ♂; Ceres, 4 ♂, 1 ♀; Clanwilliam, 4 ♂; Bain's Kloof, 1 ♀; Caledon, 3 ♂; Tygerberg, 1 ♂, 1 ♀; Brak River, 2 ♂, 1 ♀; Swartberg Pass, 2 ♂, 1 ♀; Uitvlugt, 6 ♂, 5 ♀; Uitenhage, 1 ♂, 4 ♀; Coega, Pt Elizabeth, 1 ♂, 1 ♀; Addo Rd, Pt Elizabeth, 1 ♀; Port Elizabeth, 1 ♀; Knysna, 1 ♂, 1 ♀; Cradock, 3 ♂, 1 ♀; Sheldon, 1 ♂; Melkbosch Strand, 1 ♂; Beaufort West, 3 ♂, 4 ♀; Hofmeyr, 1 ♂, 1 ♀; Grahamstown, 1 ♂; Eastpoort, 4 ♂, 4 ♀; Waverley, 1 ♀; Aberdeen, 1 ♂; Vlekpoort, 1 ♀; Queenstown, 1 ♂, 1 ♀; Graaff Reinet, 1 ♂, 1 ♀; Annshaw, 2 ♂; Kimberley, 3 ♀. ORANGE FREE STATE: 1898 (*C. Bowker*) ex Trimen Coll., 1 ♂ (BMNH).

## ***Aloeides trimeni*** **sp. n.**

(Pl. 3, figs 113–117 and 130–134; Text-fig. 27)

*Zeritis pierus* var. B; Trimen, 1866 : 275.
[*Zeritis taikosama* (Wallengren) Trimen, 1887 : 203. Misidentification.]
*Aloeides* species?; Clark & Dickson, 1971 : 229–232, pl. 107, figs 1–23.

Trimen's misidentification of *Cygaritis taikosama* Wallengren has made necessary the substitution of the present name for this species, as has been already explained under *A. taikosama* on p. 251. It is a widespread and very variable insect, having the appearance above of a small example of *A. pierus*, and as in that species varying greatly in the extent of the tawny orange areas on all wings. The underside varies on the hind wing in the colour of the ground, and in the definition of the spotting; examples occur that have these spots but weakly marked, whereas others have heavily ringed dark spots with centres exhibiting a most striking metallic lustre. The median series is slightly sinuate, but it is never broken at vein 4 as is that of *A. pierus*. In spite of the strong tendency to individual variation. it has so far been found possible to separate only one subspecies.

## ***Aloeides trimeni trimeni*** **subsp. n.**

Length of fore wing: ♂ 12–15 mm; ♀ 12–17 mm.

♂ upperside. The ground colour is dull brown, in most cases with some indication of tawny orange areas in the submarginal area of the fore wing; in more extreme cases, these areas take the form of a regular band of spots, extending from area 2 towards the costa, those in areas 2 and 3 being the larger. The holotype is of this form. Other examples are completely dull brown, and every intermediate between the two forms occurs; some examples exhibit a whitish spot at the cell end, and some a pale indeterminate tawny area at the base. In the hind wing, the general colour is dull brown, with blackish distal lunules; in the more strongly marked specimens these lunules are bordered inwardly by a band of tawny orange which is intersected by the darkened veins. The fringes are greyish with dark brown chequering at the vein ends, but this chequering is not so definite as that of *pierus*.

♀ upperside. Apart from wing shape, basically like that of the male. There is a strong tendency for the tawny areas to be more extensive, so much so that some individuals have the dusky brown areas reduced to an apical patch and a wide distal band on the fore wing, and only the costal area and apical patch of the hind wing. In such specimens the remainder of the wings is tawny orange, so producing a pattern rather like that of *damarensis* female, and certainly more usual in females of the genus. The fringes are like those of the male.

♂♀ underside. This surface is of the usual *Aloeides* pattern; the spotting on the fore wing is complete, the spots in the cell being black-ringed with clear white centres. The seven spots of the submarginal series are black, and in contrast with those of *pierus*, all are definitely touched with white inwardly. The hind wing varies in colour from greyish brown through various shades of pale brown, red-brown, but never to crimson as is the case in some other species in the genus. The spotting is regular in pattern, the individual ring-like spots, being a darker shade of the ground colour with lighter centres. In some examples these centres have a strong metallic lustre, appearing in certain lights as shining golden points.

This insect was reared on *Aspalathus* by Gowan Clark, from Port Elizabeth material.

Holotype ♂, TRANSVAAL: Witpoortje, 24.ix.1967 (*W. H. Henning*), B.M. Type No. Rh. 17237.

Paratypes. TRANSVAAL: Witpoortje, 24.ix.1967 (*W. H. Henning*), 1 ♀ (allotype, B.M. Type No. Rh. 17238); Witpoortje, 1966–1967 (*W. H. Henning*), 34 ♂, 20 ♀ (BMNH).

Material excluded from the type-series (from various collections). TRANSVAAL: Belfast, 1 ♂; Graylingstad, 6 ♂, 3 ♀; Heidelberg, 1 ♀; Pietersburg, 2 ♀; 4 ♂, 3 ♀; Pretoria, 1 ♂, 1 ♀; Johannesburg, 3 ♂, 3 ♀; Shilouvane, 1 ♂; Rustenburg, 1 ♂; Potchefstroom, 9 ♂, 6 ♀. NATAL: Frere, 2 ♂; Estcourt, 9 ♂, 3 ♀; Muden, 9 ♂, 3 ♀; Utrecht, 4 ♂, 3 ♀. ORANGE FREE STATE: Harrismith, 2 ♂, 1 ♀; Lindley, 1 ♂. CAPE PROVINCE: Annshaw, 9 ♂, 11 ♀; Healdtown, 1 ♂; Somerset East, 2 ♀; Transkei, 8 ♂, 4 ♀; Stutterheim, 3 ♂, 1 ♀; Prudhoe, 1 ♂, 1 ♀; Fort Beaufort, 3 ♂, 1 ♀; Port Elizabeth, 2 ♀; Mitchener's Pass, 1 ♂; Bedford Distr., 1 ♂; Waverley, 1 ♀; Cathcart, 6 ♂, 2 ♀; Cradock, 6 ♂, 1 ♀; Vlekpoort, 6 ♂, 1 ♀; Teebus, 2 ♀; Wanstead, East Griqualand, 4 ♂, 3 ♀. RHODESIA: Inyanga, 3 ♂, 3 ♀.

### ***Aloeides trimeni southeyae* subsp. n.**

(Pl. 3, figs 109 and 126)

As far as is known, this dark race exists in isolation in the Mossel Bay area, well to the west of any other known locality for nominate *trimeni*. It is named after Mrs R. Southey of Pretoria in recognition of her many contributions to South African entomology, and her help in connection with the present paper.

Length of fore wing: ♂ 13–14·5 mm; ♀ 15 mm.

♂ upperside. The colour is dusky brown on all wings, darker than in most examples of *trimeni*, which it otherwise closely resembles. In certain lights, a faint golden sheen is visible, but in all the specimens examined there is no indication of any tawny orange markings at all; the only marks visible are an indistinct pale spot at the cell-end on the fore wing and the vaguely indicated submarginal lunules on the hind wing.

♀ upperside. This sex is only known from the allotype. On the fore wing, the base and basal third of the costa are fuscous; the costal patch is large, dusky brown, its lower edge extending from above the cell to vein 4 in a rounded arc, and then turns towards the costa before uniting with the distal band. The distal band is wide (3–4 mm), and in areas 1 and 2 extends inwards to at least twice that width. The remainder of the wing is tawny orange the veins being heavily darkened with dusky scales. On the hind wing, the base is ochreous fuscous, which colour merges into the dusky brown outer two-thirds of the wing. The distal lunules are visible and are margined inwardly by a series of five tawny orange lunules.

♂ ♀ underside. Very like that of nominate *trimeni*, only differing in the rather more greyish tinge of the hind wing, and in the heavier dusky scaling to be seen in the subapical portion of the tawny orange area of the fore wing in the males.

This race should not be confused with certain forms of *trimeni trimeni*, having a similar appearance on the upperside. A case in point is the 4 ♂, 3 ♀ from Utrecht (Dr Kroon); these, though in the main dusky brown above, have at least vestiges of tawny orange submarginal spots on the hind wing, and a warmer tone of ground colour on the under surface. Two of the Witpoortje paratypes are also of this form, and similar specimens from the Haenertsburg area have been examined. On the evidence available, such examples can only be treated as forms of *trimeni*, possibly with some degree of dominance in some areas.

When investigating a suitable-looking spot for butterflies on the right-hand side of the national road six miles from, and west of, Mossel Bay, on the 20th November 1950, four males of this insect were found flying close to, and settling on, the ground. It was immediately noticed how dark all these specimens were, and though the basic pattern of the underside was seen to resemble that of the usual form of *trimeni* (considered at that time to be *taikosama* Wallengren), the virtually uniform blackish brown uppersides showed clearly that they were distinct from normal *trimeni* (of which the writer had much previous experience near Port Elizabeth). The locality concerned was a small, rough, somewhat stony piece of the veld lying a little lower than the surrounding ground, owing to its having been scoured out in the past after rains. The single female which was caught in 1965 was found on a hillside sparsely covered with short vegetation – 18 miles west of the first spot. *A. pierus* was much in evidence in both these localities, and both species behaved in a similar manner. (C.G.C.D.)

Holotype ♂, CAPE PROVINCE: nr Mossel Bay, 20.ix.1950 (*C. G. C. Dickson*), B.M. Type No. Rh. 17239.

Paratypes. CAPE PROVINCE: nr Mossel Bay, 20.ix.1950 (*Dickson*), 3 ♂ (BMNH), 1 ♂ (D.); Hills east side of Gauritz River Bridge, 12.iii.1965 (*Dickson*), 1 ♀ (allotype); (D.) Brak River, 2.xii.1938 (*R. C. Wood*), 2 ♂ (BMNH).

### ***Aloeides swanepoeli*** **sp. n.**

(Pl. 3, figs 118, 119, 135 and 136)

Closely allied to *A. trimeni*, and to some extent occupying parts of the range of that species, it is characterized by its widely tawny upperside, and by the usually heavy, continuous, band-like formation of the median series on the underside of the hind wing. The species has long been known to many collectors, and various suggestions have been made as to its identity. C.G.C.D. found the species on various occasions from 1953 onwards in an open area covered with short grass and low-growing plants at Botha's Hill. The butterfly was seen to have similar habits to other *Aloeides*, frequently settling on the ground after its short haphazard flights. Though decidedly active under favourable conditions, it never strayed far from its original location. The marked expanse of the tawny orange colouring of the upperside in comparison with that of *trimeni* was observed as soon as the first specimens were caught, and it was realized that this feature was of considerable significance. Mr Swanepoel (*in litt.*) referred to it recently as 'species X', and writing of the species in the Munnik-Soekmekaar district of Transvaal says: 'This then is the picture. Here in a small area *trimeni* flies all by itself. Not far away, sometimes a quarter of a mile or nearer, X flies by itself. I have seen these two species in many places there; in a few they were together. The conclusion that I have come to is that they have nothing to do with one another. As X extends further southwards into Natal, it occurs in many places here and there along the eastern slopes of the Drakensberg Range where *trimeni* is often completely absent. There is no doubt in my mind that it is a distinct species.'

Fore wing length: ♂ 13–16 mm; ♀ 15–18 mm.

♂ upperside. The fore wing is predominantly pale tawny orange, and has an apical patch of moderate size and a distal band of up to 3 mm in width. The tawny colour penetrates towards the costa usually in the form of tawny spots in areas 5, 6 and 7. In the median area the veins are darkened by dusky scales. On the hind wing the ground colour is like that of the fore wing; the basal third of the wing, the costal region above the cell and vein 6, extending into area 5 below the apex, and a series of submarginal spots fused to the distal lunules, are all dusky brown. The veins are less strongly darkened than those on the fore wing. The fringes on all wings are pale fuscous with dark chequering at the vein-ends.

The great extent and more tawny tone of the ground colour serve to distinguish this species from *A. trimeni*.

♀ upperside. Apart from wing-shape, this sex does not differ from the males, except that the tawny ground colour tends to be even more widely extended.

♂ ♀ underside. The fore wing is deeper tawny orange than the upperside. The pattern is as in *trimeni* with well marked silver-white black ringed spots. The submarginal series and the marginal dots decrease in size and definition as they near the apex. The costal and distal areas of the wing are of matching colour with the hind wing. This varies individually in colour from greyish fawn to rich reddish tawny brown, the spotting consisting of brownish rings with paler somewhat silvery centres. The median series is well marked, continuous, and slightly sinuous, and gives a rather striking band-like effect in most examples.

The species is named after Mr D. A. Swanepoel in acknowledgement of his helpful criticism.

Holotype ♂, NATAL: Botha's Hill (above railway line) 2,500′, 29.ix.1953 (*C. G. C. Dickson*), B.M. Type No. Rh. 17241.

Paratypes. NATAL: Data as holotype, 1 ♀ (allotype, B.M. Type No. Rh. 17242); as holotype, 21.ix.1953, 2 ♂, 21.x.1953, 1 ♀ (D.); Estcourt, 14–15.ix.1967 (*D. M. Kroon*), 2 ♂, 1 ♀ (Kr.); Estcourt, 1895 (*Hutcheson*), 2 ♂ (BMNH); Estcourt, ix–x. 1896 (*Marshall*), 5 ♂, 1 ♀ (BMNH); Estcourt (Trimen Coll.), 3 ♂, 4 ♀ (BMNH); Muden (*Cookson*), 9 ♂, 13 ♀ (BMNH), 5 ♂, 1 ♀ (TM, Pretoria); Frere, 10.xii.1896

(*Marshall*), 1 ♂ (BMNH); Utrecht, 16.ix.1967 (*Kroon*), 1 ♀ (Kr.); Ulundi, ix. 1896 (*Marshall*), 4 ♂, 2 ♀ (BMNH); Empangeni, Zululand, 1913–1914 (*Higgins*), 3 ♂, 2 ♀ (BMNH). TRANSVAAL: Shilouvane (*Junod*), 4 ♂ (BMNH); Munnik, 2.x.1946 (*Henning*), 1 ♂ (BMNH); Munnik, 17.viii.1944 (*Pennington*), 1 ♂ (Penn.); Munnik, 3.x.1961 (*Plowes*), 1 ♂ (Pl.); Wolkberg, x. 1942 (Swanepoel), 1 ♀ (BMNH); Barberton, 5 ♂ (BMNH); Carolina, 14.x.1961 (*Plowes*), 4 ♂ (Pl.); Fairview Mine, Barberton, 10.x.1961 (*Plowes*), 1 ♂ (Pl.); Zoekmekaar, 28.x.1959 (*Plowes*), 1 ♂ (Pl.); Zoutpansberg, 1957–1959, 3 ♂ (Pl.); Louis Trichardt (*H. G. Breijer*), 3 ♂, 5 ♀ (TM, Pretoria).

Coloured photographs of examples of this species have been received from Mr L. N. Schroder, who caught the specimens at Mhlambinyati, Swaziland in October 1967.

## ***Aloeides aranda*** (Wallengren)

(Pl. 3, figs 120, 121, 137 and 138; Pl. 4, figs 139–148 and 156–165; Text-fig. 28)

*Cygaritis aranda* Wallengren, 1857 : 43. LECTOTYPE ♂, by present designation, 'Caffraria' (NR, Stockholm) [examined].

*Zeritis mars* Trimen, 1862 : 285. Holotype ♂, CAPE PROVINCE: Knysna (depository unknown).

*Aloeides zilka* Grose-Smith, 1900 : 121, pl. 26, figs 1–2. Holotype ♂, SOUTH AFRICA (BMNH) [examined].

*Zeritis rougemonti* Oberthür, 1909 : 98. Holotype ♂, TRANSVAAL: Shilouvane, Zoutpansberg (*Junod*) (BMNH) [examined].

*Phasis marshalli* Aurivillius, 1924 : 427. Holotype, RHODESIA: Gazaland* (depository unknown).

*Aloeides aranda aranda* (Wallengren) Clark & Dickson, 1971 : 221–224, pl. 104, figs 1–23.

Length of fore wing: ♂ 11–16 mm; ♀ 13–17 mm.

♂ upperside. The ground colour is pale tawny orange with a slightly more yellow tinge than in most other species in the genus. The fore wing apical patch and distal band are dusky brown in colour, and of individually variable extent. On the hind wing, the tornus is strongly produced at vein 1, imparting an almost tail-like appearance. The colour is as in the fore wing; the apical patch is dusky brown, subquadrangular in shape, and rarely extends far below vein 6, the distal margin being only narrowly margined with dusky brown. The fringes are variable; in some examples, they are pale fuscous with more or less chequering at the vein-ends, some have a definite rosy tinge, while in some dark individuals (*mars*), the fringe of the fore wing is completely dusky brown as in the distal band.

♀ upperside. Apart from the broader wings, this sex is as in the male.

♂ ♀ underside. On the fore wing tawny orange; the cell spots and median series are all present, being well formed, black ringed, and with clear silver-white centres; the black submarginals decrease in size from area 1 towards the apex, those nearest the apex being but poorly defined. These spots are not marked with white. The apical and distal portions of the wing and the entire hind wing vary individually in colour from ochreous brown to deep crimson. The spotting on the hind wing is very variable; in most of the ochreous brown examples the spots are dusky, and poorly marked; in the crimson ones the spots are often whitish, and stand out clearly.

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* Aurivillius gives 'Gazaland' as the type-locality, and states that he received the specimens from Sir Guy Marshall. As the name Gazaland appears in many maps to cover a large area of Mozambique, it seems desirable to point out that the southern Melsetter area around Mt Selinda and Chipinga in Rhodesia adjoins Portuguese Gazaland, and is also known by that name. Sir Guy did live and collect in this area.

♂ genitalia. There are two patches of recurved hooks on the aedeagus; the cornutae within the vesica are small in size. On the clasper, the dorsal edge is rounded, and without any protruding point.

The species constitutes a gigantic though far from regular cline spreading from the heavily marked population of the western Cape Province eastwards in an amazing variety of wide-bordered and narrow-bordered forms to culminate in the weakly marked *marshalli*-like form in Mozambique. It also extends northwards to Malawi (Ncheu, *J. D. Handman*) and to Tanzania (Lupembe, *F. Zimmer*); in the BMNH there is a single ♂ example from Libollo, Angola (*Pemberton*). The populations from the geographic extremes of the range can in no way be confused, but in the intermediate areas the multiplicity of forms renders any attempt at subspecific division impossible. The published names refer in each case to an individual form which is not representative of the population as a whole in the area concerned; they can therefore only be treated as names of less than subspecific rank. Through the kindness of Dr Per Inge Persson of the Naturhistoriska Riksmuseum, Stockholm, it was possible to examine Wallengren's four syntypes of *Cygaritis aranda*; they consist of a well matched pair (male and female) with moderately wide margins and apical patch on the fore wings. These two specimens are hereby designated as lectotype male, and allolectotype female. Both the other specimens are males; one is poorly marked with narrow apical patch and distal border, the latter diminishing in width from the apex, and terminating at vein 2; the other is intermediate in the development of its dusky markings. All four are labelled 'Caffraria', a somewhat imprecise locality which might indicate any area inhabited by the Kaffers; Trimen (1887 : xii) refers to Colonel Bowker's collecting in Kaffraria and mentions that the name covers the area between the Great Kei and Bashee rivers. On the frontispiece map to Trimen's South African Butterflies, Kaffraria is shown as covering that area and most of Pondoland; it seems reasonable therefore to assume that Wallengren (who was a contemporary of Trimen) would have similar views on the matter. The Wallengren syntypes agree well with more recent specimens from the area concerned.

Form *mars* Trimen. This, the predominate form in the western Cape Province shows the greatest development of the dark margins above; the triangular apical patch with the distal band form an uninterrupted heavy black margin on the fore wing. The apical patch on the hind wing is also larger and darker than in typical *aranda*. In the eastern Cape Province it does in places occur together with typical *aranda* and *marshalli*-like examples, occasional specimens being difficult to assign to either taxon.

Form *rougemonti* Oberthür. From the type and three paratypes, this form is of doubtful significance; all four examples are very similar to one another, and are in fact intermediate between typical *aranda* and form *marshalli*, the apical patch and distal band on the fore wing being narrower than in *aranda*, and the wing shape rather more rounded. All come from Shilouvane, although the data label of the type appears to have become detached. Oberthür states 'Décrit d'après plusiers examplaires capturés dans le pays d'Shilouvane (Zoutpansberg, Nord-Transvaal) par M. le missionaire Junod'. The name Shilouvane does not appear on any available map, but Dr Cottrell suggests that it is most probably a misspelling of Shiloubane near Tzaneen.

Form *zilka* Grose-Smith. This is the form exhibiting the greatest reduction in the development of the dusky margins. In the type, the apical patch on the fore wing is reduced to an attenuated smear extending parallel with but not touching the outer half of the costa, and its lower edge not reaching vein 6. The distal band is approximately 2 mm wide at the costa, rapidly narrowing to vein 3, whence it continues linearly to the anal angle. On the hind wing, the apical patch is entirely absent, and the wing is without markings except for a marginal dark line. The exact location of the type-locality is not known, but two examples from Inyanga, Rhodesia in BMNH are very like the type, and Dr Cottrell (in litt.) mentions two others from Headlands; it does appear that the type may well have originated in that area. It can only be treated as an extreme form of *marshalli* occurring together with that form, typical *aranda*, and many intermediates.

Form *marshalli* Aurivillius. On the fore wing above, the marginal band terminates at vein 2, and encloses small yellowish submarginal spots in areas 2, 3 and 4; in one female example from Inyanga, these spots are continued as a series of seven rounded orange spots extending upwards to the apex. The apical patch is usually only slightly larger than that of *zilka*, streak-like, and not extending below vein 6. The apical patch on the hind wing is present but never so well developed as that of typical *aranda*. A series of specimens from Inyanga contains both forms *zilka* and *marshalli*, together with f. *aranda* and intermediates. The type was collected by G. A. K. Marshall and the locality given as 'Gazaland' must refer to the Chipinga region in S.W. Rhodesia. A series of 10 ♂, and 3 ♀ from the Delagoa Bay area are all of the *marshalli* form, but are considerably smaller than the Inyanga specimens. A pair from Muzi Forest, Ingawumu, Zululand, exhibit some affinity with Rhodesian *zilka-marshalli* forms (Pl. 3, figs 120, 121, 137 and 138).

*A. aranda* usually occurs in more or less mountainous areas, but is sometimes found in low-lying sandy tracts near the coast. It has been observed that specimens taken in the latter type of habitat (i.e. near Mamre in the Western Cape) often have the underside markings on the hind wings noticeably white and conspicuous. Examples with the dark areas of the upperside abnormally developed have been encountered near Cape Hangklip. Much variation in the general tone of the underside (from sandy brown to rich lake) occurs in examples from any given locality. The butterfly behaves in a manner similar to other ground-frequenting species of the genus, sometimes settling on low-growing vegetation as well as on the ground itself. It was reared by Gowan Clark on *Aspalathus* (Leguminosae).

DISTRIBUTION. Cape Province; Swaziland; Natal; Transvaal; Rhodesia; Mozambique; Tanzania (Lupembe); Malawi (Ncheu); Angola (Libollo). Over 200 specimens have been examined.

### *Aloeides henningi* sp. n.

(Pl. 4, figs 149, 150, 166 and 167; Text-fig. 30)

*Aloeides* sp. ? Clark & Dickson, 1971 : 225–228, pl. 105, figs 1, 2, 3, 4, 6, 8, 10, 12 and 14. [Life-history.]

This insect has long been treated as *Aloeides almeida*; it does however exhibit constant differences in facies, male genitalia, and ecology, and must therefore be accorded specific status. In acknowledgement of their help, and many generous gifts of specimens to the BMNH, the species is named after Mr W. Henning and his sons Graham and Stephen of Florida, Transvaal. Mr Henning points out that in the Strubens Valley area the species is single-brooded, not appearing after November.

Length of fore wing: ♂ 14–16 m; ♀ 14–17 mm.

♂. Very similar to *A. almeida*, differing as follows; the fore wing is shorter, its apex being distinctly more acute; the distal margin is less strongly convex; on the upperside, the tawny orange ground is brighter and clearer, and the veins very finely lined black. The apical patch and distal margin are deep black brown, arranged as in *almeida*; but aberrant examples do occur in which the black brown colour encroaches into the tawny orange ground, and in some extreme cases completely replacing it on all wings. The hind wing only differs from that of *almeida* in its brighter colouring, and less heavily blackened veins. The pale fuscous fringes are spotted with dusky brown at the vein ends.

♀. Not noticeably different in shape from that sex of *almeida*, but the more typical specimens have the tawny orange areas brighter, more extensive, and much more finely darkened on the veins. The markings on all wings are as in *almeida*, although as in the male, individuals do occur with a strong tendancy to melanism.

♂♀ underside. This surface only differs from that of *almeida* in that the spots in the cell and disc of the fore wing are larger, and their silver-white centres more striking. The submarginal spots are smaller and well separated, whereas those of *almeida* are large, tending to fill almost the whole area between the veins, and thus are much closer together.

♂ genitalia. The aedeagus has a well developed patch of recurved hooks on its right side, but unlike *almeida*, is entirely without such a patch on the left side. On the dorsal edge of the clasper, the projection is only represented by an obtuse angle; it is never finger-like as in species like *taikosama*.

This species was reared on *Aspalathus* by Gowan Clark.

Holotype ♂, Transvaal: Struben's Valley, Constantia Kloof, 22.x.1967 (*W. H. Henning*), B.M. Type No. Rh. 17243.

Paratypes. Transvaal: data as holotype, 1 ♀ (allotype, B.M. Type No. Rh. 17244), 14 ♂, 4 ♀ (BMNH); locality as holotype, various dates, 1 ♂, 4 ♀ (Henn.); Pretoria, 1.xii.1945 (*N. Impey*), 1 ♂ (TM, Pretoria); Pretoria, 1945–49 (*van Son*), 2 ♂, 1 ♀ (TM, Pretoria); Pretoria, ix. 1897 (*C. J. Swierstra*), 1 ♀ (TM, Pretoria); Fountains, Pretoria, 31.x.1959 (*Plowes*), 1 ♀ (Pl.); Johannesburg, 4 ♂, 2 ♀ (BMNH); Johannesburg, 15.x.1951 (*A. L. Capener*), 4 ♂, 1 ♀ (TM, Pretoria); Johannesburg, ix–x. 1902–3 (*A. Ross*), 4 ♂, 2 ♀ (BMNH); Fairview Mine, Barberton, 12.x.1961 (*Plowes*), 2 ♀ (Pl.); Sheba Mine, Barberton, 11.x.1949 (*van Son*), 1 ♂ (TM, Pretoria); Irene, 11.x.1908 (*Swierstra*), 1 ♀ (TM, Pretoria); 5 miles N. of Volksrust, 15.x.1961 (*Plowes*), 1 ♂ (Pl.); Pilgrim's Rest, 4.x.1961 (*Plowes*), 1 ♂ (Pl.).

Material excluded from the type-series. NATAL: Muden, 12.i.1947 (*H. Cookson*), 1 ♂ (BMNH); Muden, 12.x.1951 (*Cookson*), 1 ♀ (TM, Pretoria); Greytown Hills, 25.x.1954, 1 ♀ (TM, Pretoria); Estcourt, 10.x.1890, 1 ♂ (BMNH); Beaconsfield, Escourt, 14.xi.1949 (*Plowes*), 1 ♀ (Pl.); Fairleigh, Estcourt, 5.xi.1959 (*Plowes*), 4 ♂, 6 ♀ (Pl.). LESOTHO: Maseru (*Bowker*) ex Trimen coll., 2 ♂ (BMNH); Maseru, x. 1901 (*Crawshay*) 6 ♀ (BMNH); 'Basutoland' (*Bowker*), ex Trimen coll., 1 ♂ (BMNH). ORANGE FREE STATE: Dewetsdorp, 28.xi.1967 (*Mrs R. J. Southey*), 1 ♂ (BMNH); Ladybrand, 20.xi.1931, 1 ♀ (NMR, Bulawayo). EAST GRIQUALAND: Umzimkulu, 9.v.1926 (*Pennington*), 1 ♂ (Penn.); Lundean Pass, 29.xi.1967 (*L. Southey*), 3 ♀ (BMNH).

## ***Aloeides almeida*** (Felder)

(Pl. 4, figs 154, 155, 171 and 172; Text-fig. 31)

*Nais almeida* Felder, 1862 : 478. Holotype ♂, CAPE PROVINCE: 'Cap.' (*Frauenfeld*), ex Felder coll. (BMNH) [examined].

*Zeritis almeida* (Felder) Trimen, 1887 : 200, partim.

In the past, this name has been made to include the taxa now described as *henningi* and *macmasteri*; the elucidation of the complex now requires that an attempt be made to decide from which area in the Cape Province the holotype actually came. Careful comparison with the material in the BMNH reveals that it does in fact agree exactly with examples from the Knysna area (some of which were also originally in the Felder collection), and it can be safely assumed that the holotype originated from that district.

Length of fore wing: ♂ 12–14 mm; ♀ 14–16 mm.

♂. The fore wing is rather broader than that of *A. henningi*, its apex less acute, and the strongly convex distal margin is in many examples slightly angled at vein 5. On the upper side, the tawny orange ground is much constricted by the heavy dusky brown marginal markings, and the veins are strongly darkened by blackish scales. The apical patch is wide, extending almost to vein 4, and almost to the base of the costa, being weakly sprinkled with yellowish scales in the latter area. On the hind wing, the apical patch is subquadrangular and united with the dusky costal area. The distal lunules are united in a continuous wavy band. In the tawny orange area, the veins are darkened as are those of the fore wing. The fringes are fuscous with darker chequering at the vein-ends.

♀. The wings are broader, but are marked much as in the male. In many examples the tawny orange ground extends through the apical patch of the fore wing towards the costa in the form of three interneural spots in areas 4, 5 and 6.

♂♀. On the underside, the costal and distal areas of the fore wing vary individually in colour from earth-brown through various shades of red-brown to deep crimson. On the fore wing, the spots in the cell and the median series are all present, but are rather small; the submarginal series are large, without white centres, and decrease in size as they approach the apex; between them and the margin is a series of tiny black spots. The pattern of the hind wing consists of rather vague and small dusky spots; the basal spots are rounded, that at the cell-end elongate, all having dimly-seen yellow-brown centres; those of the median series are crescent-shaped, well separated, and each is accompanied internally by a touch of yellow-brown. The submarginal series of lunules is scarcely visible, but is followed by a series of rounded cloudy dusky spots.

♂ genitalia. The aedeagus differs from that of *A. henningi* in both that left and right side bear a patch of recurved hooks.

MATERIAL EXAMINED.

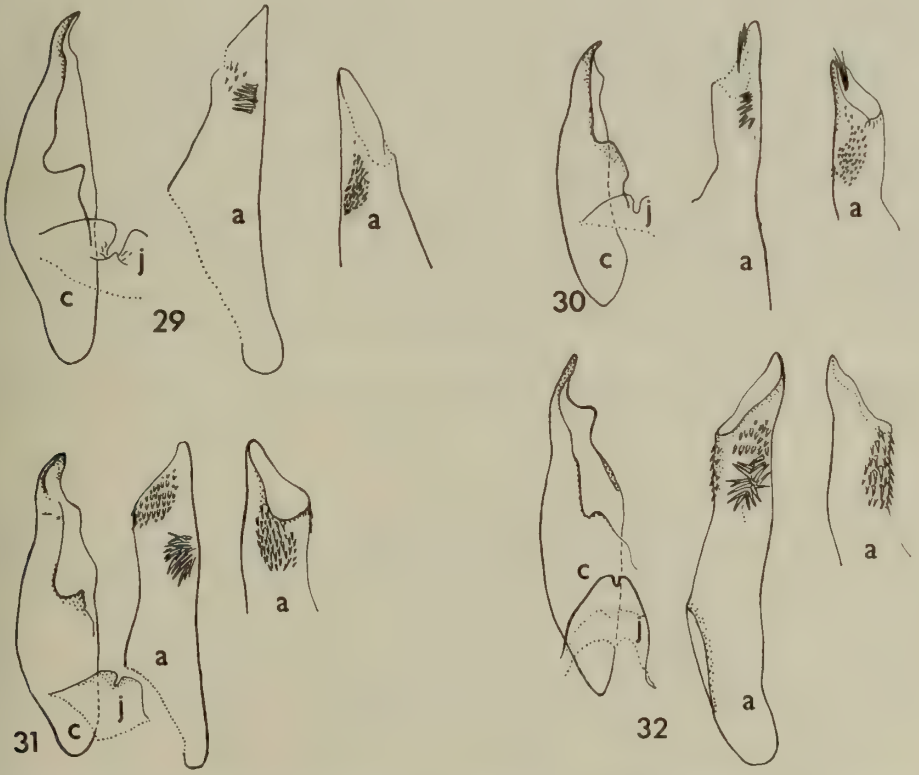
CAPE PROVINCE: Cape Town, 4 ♂, 1 ♀; Plettenburg Bay, 2 ♂; Knysna, 2 ♂; Oudtshoorn, 1 ♀ (all BMNH).

## ***Aloeides macmasteri* sp. n.**

(Pl. 4, figs 152, 153, 169 and 170; Text-fig. 32)

[*Zeritis almeida* (Felder); Trimen, 1887 : 200, partim.]

This, the largest and handsomest member of the *almeida* complex, inhabits the more western parts of Cape Province, but is known to extend westward as far as Kamieskroon in Little Namaqualand; it differs from *almeida* in size and wing-



FIGS 29–32. Male genitalia of *Aloeides*. 29, *A. pierus*; 30, *A. henningi*; 31, *A. almeida*; 32, *A. macmasteri* (j = juxta, c = clasper, a = aedeagus, in each case).

shape, and is best treated as a distinct species. The late Mr G. C. Clark knew the species well and was also of the opinion that it was distinct. The name is put forward in recognition of the generous loan of specimens, and of help given by Mr J. C. McMaster of Stutterheim.

Length of fore wing: ♂ 14·5–17·5 mm; ♀ 15–20 mm.

♂. The fore wing is much longer in proportion than that of *almeida;* on its upper side, the tint of the tawny orange ground is brighter, and the veins are clearly marked with black. In the holotype the apical patch is large, but is partially divided in areas 4, 5 and 6 by three internervular spots of the ground colour; the wide distal margin measures approximately 3 mm at its narrowest point at vein 3; a scattering of black scales extends from its inner edge in area 1 and across areas 2 and 3 to join the lower edge of the apical patch. In some examples, this scattering is much more intense, dividing the tawny orange area into two parts, so that specimens do occur in which the tawny orange is confined to the basal third of the wing, and to two rounded spots in areas 2 and 3. On the hind wing, the apical patch is united with the wide dusky costal area, and extends downward to between veins 4 and 3; some examples have a dusky scattering – similar to that of the fore wing – extending across the wing to the hind margin. In the darkest specimens, the basal two-thirds of the wing are black-brown, leaving only the outer portions of areas 1, 2, 3 and 4 tawny orange. The cilia on both wings are lighter and more obviously chequered than those of *almeida*, the fringe at the anal angle of the fore wing being noticeably whiter.

♀ upperside. The pattern is basically like that of the male, but the tawny orange areas are usually more extensive, and the tawny orange spots dividing the apical patch are larger. The distal band is approximately 4 mm wide at vein 3, but extends in area 1 to a width of about 6·5 mm; in many examples, this portion is joined to the apical patch by a shadowy band as in the male. The basal portion of the hind wing is paler fuscous, the wing being otherwise like that of the male.

♂ ♀ underside. The fore wing ground colour is paler tawny orange than that of *almeida*, the margins being pale brown with a tinge of salmon; the hind margin and the anal angle are broadly white. The spotting is similar to that of *almeida*. On the hind wing, the ground is the same colour as the fore wing margin, and the markings do not differ from those of *almeida*.

The male genitalia differ from those of the previous species only by their greater size.

Holotype ♂, CAPE PROVINCE: Hillmoor, Steynsburg, 21.xi.1965 (*Mrs R. J. Southey*), B.M. Type No. Rh. 17245.

Paratypes. CAPE PROVINCE: as holotype, 1 ♀ (allotype, B.M. Type No. Rh. 17246), 1 ♂, 2 ♀ (BMNH); Hillmoor, Steynsburg, 19.xii.1963 (*Mrs Southey*) 1 ♀ (Q.); Steynsburg, i–ii. 1964 (*Mrs Southey*), 3 ♀ (TM, Pretoria); Eastpoort, x. 1966–7 (*J. C. McMaster*), 2 ♂, 3 ♀ (McM.); Katberg, xi. 1940 (*McMaster*), 1 ♂ (NMR, Bulawayo); Cathcart, 1964–6 (*McMaster*), 4 ♂, 1 ♀ (McM.); Cathcart, 13.x.1963 (*C. D. Quickelberge*), 1 ♂ (Q.); Gaika's Kop, Amatola Mtns, 26.xii.1965 (*McMaster*), 1 ♂ (McM.); Isidenge, 11.xi.1964 (*McMaster*), 3 ♂ 1 ♀ (McM.); Sheldon, 4.x.1934, 1 ♂ (BMNH); Murraysburg, ex Trimen Coll., 1 ♂, 2 ♀ (BMNH); Coega, xii. 1948, ex Jackson Coll., 2 ♀ (BMNH); Port Elizabeth, x. 1965, ex Jackson Coll., 1 ♀ (BMNH); Glenconnor, 26–7.xi.1942 (*G. C. Clark*), 2 ♀ (TM, Pretoria); Carlton, 16.xi.1936 (*Clark*), 2 ♀ (TM, Pretoria); Aberdeen District, 20.iii.1940 (*G. van Son*), 1 ♀ (TM, Pretoria); Wolvefontein, 1.iii.1943 (*Clark*), 1 ♀ (TM, Pretoria).

## ADDENDA TO THE *ALOEIDES THYRA* COMPLEX

### *Aloeides caledoni* sp. n.

(Pl. 4, figs 151 and 168)

This species, recently discovered by C.G.C.D. at Shaw's Mountain, Caledon District, bears some resemblance to *Aloeides quickelbergei* Tite & Dickson (1968 : 381, pl. 3, figs 54–55 and 65–66); it does however exhibit a number of quite distinctive characters.

Length of fore wing: ♂ 17–18 mm.

♂. In appearance similar to that sex of *A. quickelbergei;* the fore wing is less pointed, and the distal margin less straight, being very slightly angled at vein 4. On the upperside, the tawny orange ground is bright and clear, undarkened at the veins, and lighter in colour than that of *quickelbergei*. The fore wing apical patch is narrower, and extends only just over half the length of the costa; whence it continues along the subcostal vein as a thin pointed streak. The base of the costa is widely ochraceous. The distal band is narrow, seldom exceeding 2 mm in width at vein 3, and diminishing slightly as it approaches the anal angle, whereas that of *quickelbergei* is definitely widened in area 1. On the hind wing, the apical patch is narrow and band-like, not at all quadrangular. The cilia on all wings are white with dusky brown chequering at the vein-ends. On the underside of the fore wing, the absence or vestigial nature of some of the spots gives a much plainer appearance than is to be seen on any other species in the genus. The ground colour is paler tawny orange than that of the upperside, fading to pale straw-yellow at the hind margin. The costal and distal margins coloured as in the hind wing. The three well defined cell spots are black ringed with white centres; in one example, the basal and middle one are joined by a black bar in both fore wings. The median series are all small, sometimes vestigial, and usually only present in areas 3 to 7. The submarginal series is represented by a clouded dusky spot in area 1, tiny or obsolescent dots in areas 2 and 3, no spots being discernable between this point and the apex. On the hind wing, the colour is a smooth rich crimson, not so deep as that of *quickelbergei* but quite striking. All the spots from the base to the median series are white faintly edged with blackish, while the submarginal series is either absent or scarcely discernible. The marginal white dots are not present. One specimen is in very rubbed condition, and probably because of this, the ground appears to be more fuscous than crimson, and the pattern is scarcely traceable.

In fresher specimens, there is a conspicuous vinous colouring on the head, the upper part of the body, and a tinge of the same colour on the fringe of the hind wing.

♀. Unknown.

The original specimen was taken by C.G.C.D. on the 3rd November, 1967. It was flying on the rather flat summit of a small rocky hill on which *A. aranda* f. *mars* was present in small numbers. This insect was decidedly quick on the wing, but it settled once or twice near the edge of the hill, and was eventually captured. Although not a fresh specimen, it looked very bright when flying in the sunshine, and was – in this respect – reminiscent of one of the larger European coppers. As it obviously represented a previously unknown *Aloeides*, an intensive search was made for more specimens, but without success either on that day or in later searches during the same season. This seems to suggest that it is a single-brooded species with an early flight period; however, complete evidence of this is still lacking. A point was made of revisiting the locality at an earlier date in the following season, and although no further specimens could be found on the little hill itself, others were located in the vicinity.

Holotype ♂, Cape Province: Shaw's Mountain, south of Caledon, 28.x.1968 (*C. G. Dickson*), B.M. Type No. Rh. 17247.

Paratypes. Cape Province: as holotype, 3 ♂ (BMNH), 1 ♂ (*D*); as holotype, 3.xi.1967, 1 ♂ (*D*).

### ***Aloeides juana*** Tite & Dickson **stat. n.**

*Aloeides vansoni juana* Tite & Dickson, 1968 : 379, pl. 3, figs 48, 51, 59, 62. Holotype ♂, Cape Province: hills 3½ miles south of Ladismith, 1.ix.1965 (*C. G. Dickson*) (BMNH) [examined].

Since the description of this taxon, several well-authenticated reports of its being observed flying together with typical *A. vansoni vansoni* have come to hand. C.G.C.D. found the two insects flying together on a mountain near Prince Albert on the Swartberg Pass in November 1969. Mr Plowes found both species in Little Namaqualand at Struder's Pass, and kindly sent specimens of each on loan for identification; these were taken in November 1969. Mr Swanepoel reports that during his collecting trips in 1968–1969, he too found the two species together, and formed the opinion that they were distinct. He claims to have detected differences in their habits. There is no doubt therefore that *juana* is in fact a species completely separate from *vansoni*. Mr Pennington confirms that many specimens in his collection support the difference.

### ***Aloeides pallida littoralis*** Tite & Dickson

*Aloeides pallida littoralis* Tite & Dickson, 1968 : 375, pl. 2, figs 25, 26, 35 and 36, Knysna.

The capture of a series of this subspecies at Hermanus, Cape Province, on 7.xi.1970 by Mr C. J. Rossouw further extends its known range to the west, and tends to confirm that it is a lowland maritime race. All these examples are remarkable for their brilliant colouring, and their strikingly emphasized underside wing-pattern.

## NOTES ON THE EARLY STAGES OF *ALOEIDES TRIMENI* SP. N. AND *A. DENTATIS* (SWIERSTRA).

*By* C. G. C. Dickson

### *Aloeides trimeni*

(Pl. 5, figs 178–181)

The eggs of this species were obtained at Witpoortjie, Transvaal, by Mr W. H. Henning, with the help of his sons Stephen and Graham – the food-plant proving to be *Hermannia depressa* N. E. Br. (Sterculiaceae). No plant of this genus had been known before to be used as a food-plant by any of the species of *Aloeides*. Eggs were laid singly on the young leaves or buds. From one of these eggs the species was reared to the adult stage, in Cape Town, and during this period Mr Henning very obligingly maintained a constant supply of fresh food-plant by air-mail. No ants were in attendance at any time when the larva was being reared.

*The egg* is 0·8 – 0·9 mm in diameter and is rather deeply 'bun-shaped'. The surface sculpturing is moderately fine, and consists of well raised protuberances connected by small, concavely arched ridges. The micropyle is sunken. When first laid, the colour is creamy white, but in time darkens considerably. The egg in question was laid in early November 1948, and hatched approximately two weeks later.

*The larva, 1st instar.* On emergence, the larva is 1·5 mm in length, when moderately extended, and during this instar is of a light yellowish colour, streaked longitudinally with vinous colouring, and marked at each end with the same colour. The head is rounded, very dark brown to black, shiny, and with some short white setae. The neck shield, and the very small circular anal shield are both brown. The retractile tubercles are already present in the usual position on segment xi, with the exterior portion of each tubercle in the form of a fleshy protuberance, but the honey-gland is not developed at this early stage. The setae on the body of the larva are mostly of moderate length, but with some shorter ones. They are largely pale in colour, but some, including the dorsal series, are dark-coloured. A stout lateral series is light-coloured with rounded club-shaped ends. The instar lasts approximately two weeks, at the end of which the length of the larva is 2·5 mm.

Descriptive note on the second to fourth instars have not been made. After the first moult the larva bears a much closer resemblence to the final instar. The retractile tubercles have chitinized casings after the first moult.

*2nd instar.* The duration is 18 days. The length of the larva at the end of the instar is 4·5 mm.

*3rd instar.* The duration is 16 days. The length of larva at the end of the instar is 7 mm.

*4th instar.* The duration is 15 days. The length of the larva at the end of the instar is 10 mm.

*5th instar.* The head is dark brown to blackish, with numerous very short white setae. The neck shield and anal shield are light-brown. The general colour of the body is pale green, with darker green longitudinal streaks, the double medio-dorsal ones relatively straight and the others irregular; each of the second series (i.e. second from the centre line of body) has an ochreous patch on segments ii to ix. The chitinous tubercle casings have the usual protective spines round their rims. The setae vary much in length, the longest occurring at the anterior end of the body, towards the posterior end of an outer dorsal series, and at the posterior end of the body. The setae are either light- or dark-coloured. As is usual in the more advanced larvae of this general group of butterflies (i.e. in most of the instars) the body is covered with numerous very short setae of a specialised type, with horizontally expanded ends, and these contribute to part of the pattern, as on the anal shield, which bears two concentrations of white setae of this type. The light coloured lateral setae, referred to in the description of the first instar, besides being more numerous than at that stage (as is the case with the setae in general) are now relatively smaller and less robust. The duration of the instar is 17 days. The length of the larva at the end of the instar is 15 mm.

*6th (final) instar.* This instar is very similar to the previous one, and the description already given can be applied in general to the present instar. The ochreous patches which are combined with the second series of longitudinal streaks are more prominent, and are of richer colour. As is normally so in larvae of this group, the setae as a whole have again increased in number, but are relatively shorter than before. The duration of the instar is 23 days, the larva pupating on 27.ii.1968, the final length of the larva being 20 mm.

*The pupa.* This is 11 mm in length, and is of the general form typical of this genus and allied genera. It is fairly thick in proportion to its length, is rounded anteriorly, and terminates obtusely. Its colour is finally of a brown tone. The pupal stage is 16 days, a male imago emerging on the 15th March 1968. This butterfly is a darkly marked one, with full orange colouring only in a limited portion of the hind wings. The length of the fore wing is 13·5 mm.

## *Aloeides dentatis*

(Pl. 5, figs 173–177 and 182)

Several eggs of *Aloeides dentatis* were obtained from Mr Henning. They were laid by Witpoortje females in January 1969, and from one of them a larva was reared to the third instar in Cape Town. In the following season, a pupa was found by Graham Henning in an ants' nest (*Camponotus* sp.) below plants of *Hermannia depressa*, which proved to be the food-plant of this *Aloeides* in the locality. Part of the life-history of the species can thus be recorded for the first time. The Hennings are the first to bring to light the early stages of any representatives of this genus in the Transvaal.

The larva concerned fed readily on the young leaves of the food-plant, devouring the leaf surface, and forming furrows in it, up to the end of the second instar. In the third instar, it appeared to make some slight attempt to eat the leaves, but then wandered about, and failed even to select a resting place for itself on some particular leaf as it had done formerly, and to which it always returned after its periods of feeding. Such behaviour seemed to suggest that *A. dentatis* was an exception to the known rule in this genus, and that the larva might be entirely dependent on ants from the third instar onwards, and not merely attended by them as is the case in other species of *Aloeides* whose life-histories are known. The subsequent discovery of the pupa in the ants' nest does appear to point to this being so, and it will be of great interest if the remaining larval instars are in fact found to be passed in ants' nests. The larva died eventually.

*The egg* is 0·8 mm in diameter and is deeply 'bun-shaped' in form. There is a bold surface pattern of well raised protuberences, which are more or less rimmed round their tops in the case of the largest ones, and which have some fine concavely-arched intervening ridges. The colour at first is creamy white, changing in time to somewhat purplish brown. The egg under observation was laid on 13.i.1969, and hatched 13 days later.

The larva, *1st instar* on emergence is 1·75 mm in length, and in this instar is of a pale dull stone colour (with a slightly greenish tinge), and has deep wine-red streaks. The head and the large neck shield are black; the anal shield is only slightly darker than the ground-colour. The setae are mostly dark, and their arrangement and lengths on segment vii when viewed from the side are very much as in *Aloeides gowani* (Tite & Dickson, 1968 : pl. 6, fig. 17). The long lateral setae do not increase progressively in length towards the anal end, as in *A. gowani*. The duration of the instar is 15 days, at the end of which the larva measures 3·25 mm. The larva eats only the surface of the leaf, leaving patches or short little furrows.

*2nd instar*. The head is black with light coloured setae. The large neck-shield and the small circular anal shield are dark brown. The general colour of the body is light yellowish, and the longitudinal streaks and other markings are deep vinous to vinous-brown. The black tubercle casings on segment xi are short, and bear the characteristic protective spines.

The setae of various lengths include an outer dorsal series dark in colour, some of which are fairly long, and a lateral series light in colour, including relatively long ones. The duration of the instar was 25 days, at the end of which the larva measured 6 mm.

*3rd instar.* The head is black, the body stone with deep vinous or vinous brown longitudinal streaks and markings. The tubercle cases are prominent. The head and anal shields are dark, and the setae largely black. As already mentioned the larva failed to survive.

*Penultimate* (*probably 5th*) *instar.* The discovery of one penultimate and one final instar larva of this species in an ants' nest by Mr Stephen Henning on 25th July 1970 has now made it possible to include this further portion of the life-history in these notes. Both larvae remained in a dormant state for a considerable period after their arrival at Cape Town, and the one in the final instar, without further feeding, duly pupated early in the following summer. It is thus clear that the larva hibernates if pupation has not taken place before the winter.

In the penultimate instar the head is very dark brown, and bears many lighter coloured and very short setae. The broad neck-shield, and small rounded anal shield are black, the former with a light median streak. The body is of a light stone colour with longitudinal streaks or series of broken markings of a reddish brown or somewhat vinous colour, being disposed in the manner usual in the larvae of this and allied species; the double medio-dorsal lines clearly defined, and the series of markings well above the lateral ridge are heavier and more prominent than any of the other series. Some marking of the same colour also occurs on the posterior segments. Between the medio-dorsal lines and the last-mentioned series is a comparatively large patch of ochreous on the more posterior portion of each of segments 2 to 9, and with similar but less extensive colouring on segment 10. The rather short chitinous tubercle casings on segment 11 are black. The setae are of various lengths, and are most prominent subdorsally and laterally, and at the extremities of the body, others short or fairly short – occurring rather sparsely on the remainder of the surface. As is usual in the group, numerous small specialized setae with expanded heads are present on the surface of the body, accentuating the pattern in places, including some of the lighter marking. The retractile tubercles function at times with rapid beats when the larva is disturbed, the white eversile organs being clearly apparent, even to the naked eye. The larvae were not accompanied by ants at any time when they were being reared, in this or in any of the other instars. The duration of this instar could not be recorded, but 196 days elapsed between the date of its capture and the 8th February 1971, when it finally changed to the final instar. The length of the larva at the end of the penultimate instar was 13·5 mm when moderately extended.

*Final instar.* A full description of this instar is not necessary, because of its very close resemblance to the previous one. Its duration was 42 days. The larva at the end of the period measured 18 mm. It remained sluggish in its movements up to the time pupation occurred, feeding only a short distance from where it rested, and remaining inert for long periods. Pupation took place on a leaf on the lower surface of the container in which it was confined, with the pupa horizontal and lying more or less on its ventral surface, and attached by the cremastral hooks to its support. The butterfly, a somewhat small female, emerged on the 12th March, 18 days after pupation. The short pupal period in this case was presumably due to the time of year, almost the warmest part of the summer at the Cape.

For some time the larva described above was fed on *Hermannia depressa* supplied by Mr Henning, the soft leaves of which were readily devoured. It was found, however, that the yellow flowers of *Hermannia althaeifolia* were equally suitable for the purpose, although the larva appeared to reject the thick pilose leaves of this plant. The latter species of *Hermannia* was obtained on Lion's Head, Cape Town, the habitat of at least two other species of *Aloeides*. In the light of this experience, it may well prove to be one of the natural food-plants of the genus in the south western Cape, with the possibility of local larvae having adapted themselves to feeding on the leaves as well as on the flowers.

The most interesting discovery of the two advanced larvae of *A. dentatis* is described hereunder in Stephen Henning's own words:

'On the 26th July 1970, we decided to search for larvae or pupae of *Al. dentatis* at Witpoortjie as my brother Graham had discovered a pupa there the previous spring (September 1st, 1969) in the ants' nest under a stone. The veld had been burnt, but not too fiercely, and sometime previously, as parts were showing a few blades of green grass. All the *dentatis* food-plant had been burnt, and none could be located. We started on one side of their habitat systematically turning over the larger stones. Having covered most of the area with no success, I was becoming discouraged when, as I was replacing a large stone, I noticed, clinging to the under surface among the remnants of the tunnels, a large brownish-grey slug-like larva (±24 mm long). It seemed to me to be a bit too large for that of *dentatis*. I was still contemplating this as I turned over the next stone and found another larva. This was much smaller (±11 mm) and made an active attempt to escape. It was only captured after much scraping and digging with my fingers as it vanished into the heart of the ants' nest. The ants on this occasion seemed to be of a different species to the ones found attending the pupa, being smaller and more slight in structure. These were the only larvae found, but it should be noted that the veld had been burnt, including all the *dentatis* food-plant.'

From the size of the larva in the final instar which was found in the nest, it is apparent that the other larva did not increase in size to the extent which would have been expected under natural conditions. Although the smaller larva continued to eat the food-plant used in the early instars, the fact of these advanced larvae having been located in ants' nests suggests that the larva of *dentatis* might not be entirely phytophagous throughout its life in the normal environment – unless the ant association has simply led to the larva making use of the nest as a suitable retreat as well as a place in which to pupate.

*The pupa.* This is similar in form to that of *A. trimeni*, and measures 12·5 mm. When photographed by Mr. Henning, the colour was golden-brown, partly tinged with green. The colour would presumably become darker ultimately. A male imago emerged from this pupa on the 21st September 1969, its fore wing length being 13·5 mm.

## CHECK-LIST OF THE SPECIES AND SUBSPECIES OF *ALOEIDES*

***ALOEIDES*** Hübner
***thyra*** (L.)
  *nycetus* Stoll
  *evadrus* Fabricius
***pallida pallida*** (Riley)
***pallida grandis*** Tite & Dickson
***pallida littoralis*** Tite & Dickson
***dentatis dentatis*** (Swierstra)
***dentatis maseruna*** (Riley)
***braueri*** Tite & Dickson
***simplex*** (Trimen)
***vansoni*** Tite & Dickson
***juana*** Tite & Dickson
***dryas*** Tite & Dickson
***penningtoni*** Tite & Dickson
***natalensis*** Tite & Dickson
***quickelbergei*** Tite & Dickson
***caledoni sp. n.***
***oreas*** Tite & Dickson
***clarki*** Tite & Dickson
***gowani*** Tite & Dickson
***depicta depicta*** Tite & Dickson
***depicta apicalis*** Tite & Dickson
***arida*** Tite & Dickson
***lutescens*** Tite & Dickson
***egerides*** (Riley)

***margaretae*** Tite & Dickson
***molomo molomo*** (Trimen)
***molomo krooni*** **subsp. n.**
***molomo coalescens*** **subsp. n.**
***molomo mumbuensis*** Riley
***molomo kiellandi*** Carcasson
***molomo handmani*** **subsp. n.**
***barklyi*** (Trimen)
***conradsi conradsi*** (Aurivillius)
***conradsi talboti*** **subsp. n.**
***conradsi jacksoni*** **subsp. n.**
***conradsi angoniensis*** **subsp. n.**
***angolensis*** **sp. n.**
***stevensoni*** **sp. n.**
***griseus*** Riley
***taikosama*** (Wallengren) **comb. n.**
  *orthrus* Trimen **syn. n.**
***plowesi*** **sp. n.**
***susanae*** **sp. n.**
***damarensis damarensis*** (Trimen)
***damarensis mashona*** **subsp. n.**
***pierus*** (Cramer)
***trimeni trimeni*** **sp. et subsp. n.**
***trimeni southeyae*** **subsp. n.**
***swanepoeli*** **sp. n.**
***aranda*** (Wallengren)
  *mars* Trimen
  *zilka* Grose-Smith
  *rougemonti* Oberthür
  *marshalli* Aurivillius
***henningi*** **sp. n.**
***almeida*** (Felder)
***macmasteri*** **sp. n.**

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Synonyms and names of less than subspecific status are shown in *italics*.

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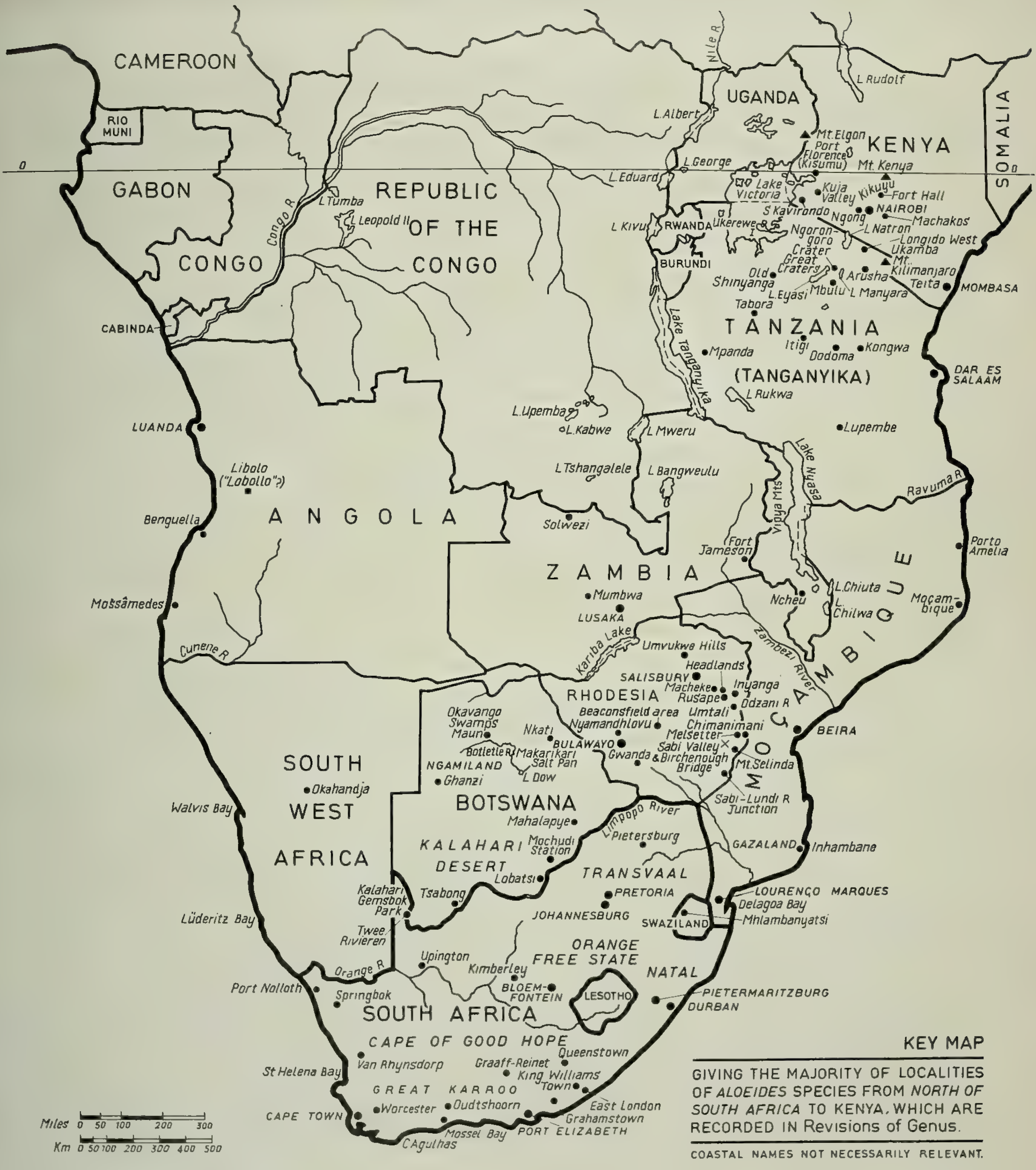
G. E. TITE
96 DUNDALE ROAD
TRING
HERTFORDSHIRE

C. G. C. DICKSON
BLENCATHRA
CAMBRIDGE AVENUE
ST. MICHAEL'S ESTATE
CAPE TOWN
SOUTH AFRICA

## LOCALITY MAPS


CAMEROON
RIO MUNI
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Port Florence (Kisumu)
Mt. Kenya
L.George
L.Eduard
Lake Victoria
Kuja Valley
Kikuyu
Fort Hall
NAIROBI
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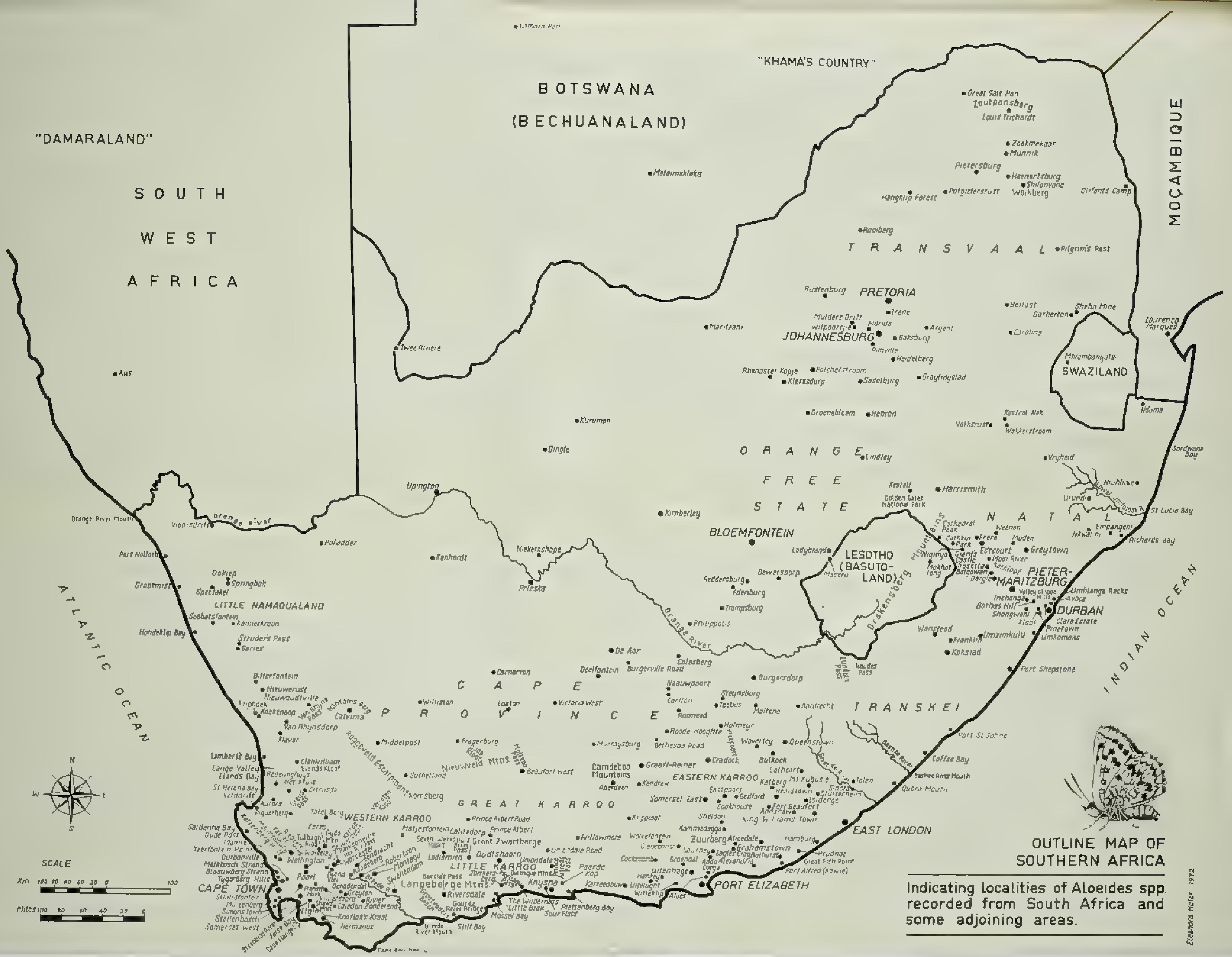
S Kavirondo
Ngong
L Natron
L Kivu
RWANDA
Ukerewe I
Ngorongoro Crater
Longido West
Ukamba
Mt. Kilimanjaro
BURUNDI
Great Craters
Old Shinyanga
Arusha
Teita
MOMBASA
L.Eyasi
Mbulu
L Manyara
Tabora
TANZANIA (TANGANYIKA)
Itigi
Dodoma
Kongwa
Mpanda
Lake Tanganyika
DAR ES SALAAM
L Rukwa
Lupembe
LUANDA
L.Upemba
L.Kabwe
L Mweru
Lake Nyasa
L Tshangalele
L Bangweulu
Ravuma R
Libolo ("Lobollo"?)
Vipya Mts
Benguella
ANGOLA
Solwezi
Fort Jameson
Porto Amelia
ZAMBIA
L.Chiuta
L. Chilwa
Mossâmedes
Mumbwa
Ncheu
Moçambique
LUSAKA
Cunene R
Kariba Lake
Umvukwe Hills
Zambezi River
Headlands
SALISBURY
Inyanga
Macheke
Rusape
Odzani R
RHODESIA
Umtali
Beaconsfield area
Chimanimani
Nyamandhlovu
Melsetter
MOÇAMBIQUE
Okavango Swamps
Maun
Nkati
BULAWAYO
Sabi Valley
BEIRA
Botletle R
Makarikari Salt Pan
Gwanda
Birchenough Bridge
Mt.Selinda
NGAMILAND
L Dow
Ghanzi
SOUTH WEST AFRICA
Okahandja
Sabi-Lundi R Junction
BOTSWANA
Limpopo River
Walvis Bay
Mahalapye
Mochudi Station
Pietersburg
GAZALAND
Inhambane
KALAHARI DESERT
TRANSVAAL
Lobatsi
PRETORIA
LOURENÇO MARQUES
Kalahari Gemsbok Park
Tsabong
Delagoa Bay
Lüderitz Bay
JOHANNESBURG
SWAZILAND
Mhlambanyatsi
Twee Rivieren
ORANGE FREE STATE
Upington
Orange R
Kimberley
NATAL
Port Nolloth
BLOEM-FONTEIN
LESOTHO
PIETERMARITZBURG
Springbok
DURBAN
SOUTH AFRICA
CAPE OF GOOD HOPE
Queenstown
Van Rhynsdorp
Graaff-Reinet
St Helena Bay
King Williams Town
GREAT KARROO
East London
CAPE TOWN
Worcester
Oudtshoorn
Grahamstown
Mossel Bay
PORT ELIZABETH
C Agulhas
Miles 0 50 100 200 300
Km 0 50 100 200 300 400 500

KEY MAP

GIVING THE MAJORITY OF LOCALITIES OF *ALOEIDES* SPECIES FROM *NORTH OF SOUTH AFRICA* TO KENYA, WHICH ARE RECORDED IN Revisions of Genus.

COASTAL NAMES NOT NECESSARILY RELEVANT.


"DAMARALAND"
SOUTH WEST AFRICA
BOTSWANA (BECHUANALAND)
"KHAMA'S COUNTRY"
MOÇAMBIQUE
SWAZILAND
TRANSVAAL
ORANGE FREE STATE
NATAL
LESOTHO (BASUTO-LAND)
TRANSKEI
CAPE PROVINCE
LITTLE NAMAQUALAND
WESTERN KARROO
GREAT KARROO
EASTERN KARROO
LITTLE KARROO
ATLANTIC OCEAN
INDIAN OCEAN
PRETORIA
JOHANNESBURG
BLOEMFONTEIN
PIETERMARITZBURG
DURBAN
EAST LONDON
PORT ELIZABETH
CAPE TOWN
Damara Pan
Aus
Twee Riviere
Orange River Mouth
Orange River
Vioolsdrift
Port Nolloth
Grootmist
Hondeklip Bay
Okiep
Springbok
Spectakel
Soebatsfontein
Kamieskroon
Struders Pass
Garies
Bitterfontein
Nieuwerust
Nieuwoudtville
Klipfhoek
Koekenaap
Van Rhyns Pass
Hantams Berg
Calvinia
Van Rhynsdorp
Klaver
Lamberts Bay
Lange Valley
Elands Bay
St Helena Bay
Velddrift
Saldanha Bay
Oude Post
Darling
Durbanville
Malkbosch Strand
Bloauwberg Strand
Tygerberg Hills
Stellenbosch
Somerset West
Simons Town
False Bay
Cape Hangklip
Steenbras River
Clanwilliam
Elands Kloof
Citrusdal
Aurora
Piquetberg
Ceres
Tulbagh
Wellington
Paarl
Worcester
Robertson
Montagu
Swellendam
Greyton
Caledon
Zonderend
Knoflokskraal
Hermanus
Elgin
Cape Agulhas
Breede River Mouth
Still Bay
Riversdale
Langeberge Mtns
Mossel Bay
Little Brak
The Wilderness
Knysna
Plettenberg Bay
Ladismith
Oudtshoorn
Prince Albert
Groot Zwartberge
Uniondale
Paarde Kop
Karreedouw
Uitenhage
Aloes
Hankey
Willowmore
Matjiesfontein
Sutherland
Komsberg
Roggeveld Escarpment
Middelpost
Fraserburg
Nieuwveld Mtns
Beaufort West
Molteno Pass
Williston
Loxton
Carnarvon
Victoria West
Murraysburg
Camdeboo Mountains
Aberdeen
Graaff-Reinet
Kendrew
Somerset East
Bedford
Cookhouse
Fort Beaufort
King William's Town
Grahamstown
Alicedale
Zuurberg
Kommadagga
Sheldon
Klipplaat
Wolwefontein
Cradock
Bethesda Road
Roode Hooghte
Hofmeyr
Steynsburg
Teebus
Molteno
Dordrecht
Queenstown
Bulkoek
Cathcart
Waverley
Burgersdorp
Colesberg
Naauwpoort
Carlton
Rosmead
De Aar
Deelfontein
Burgerville Road
Prieska
Niekerkshope
Kenhardt
Pofadder
Upington
Kuruman
Dingle
Kimberley
Philippolis
Trompsburg
Edenburg
Reddersburg
Dewetsdorp
Ladybrand
Maseru
Drakensberg Mountains
Lundean Pass
Naudes Pass
Kokstad
Franklin
Umzimkulu
Wanstead
Port Shepstone
Port St Johns
Coffee Bay
Bashee River Mouth
Qora Mouth
Tolen
Stutterheim
Isidenge
Hamburg
Prudhoe
Great Fish Point
Port Alfred (Kowie)
Kestell
Golden Gates National Park
Harrismith
Cathedral Peak
Cathkin Park
Giants Castle
Estcourt
Mooi River
Weenen
Muden
Greytown
Vryheid
Hluhluwe
St Lucia Bay
Richards Bay
Empangeni
Umhlanga Rocks
Avoca
Inchanga
Bothas Hill
Shongweni
Kloof
Pinetown
Clare Estate
Umkomaas
Lindley
Hebron
Groenebloem
Klerksdorp
Rhenoster Kopje
Potchefstroom
Sasolburg
Graylingstad
Heidelberg
Boksburg
Argent
Florida
Witpoortje
Mulders Drift
Irene
Rustenburg
Maritzani
Rooiberg
Metamaklaka
Hangklip Forest
Potgietersrust
Pietersburg
Haenertsburg
Woodbush
Zoekmekaar
Munnik
Great Salt Pan
Zoutpansberg
Louis Trichardt
Olifants Camp
Pilgrim's Rest
Belfast
Carolina
Barberton
Sheba Mine
Mhlambanyatsi
Lourenço Marques
Ndumu
Sordwana Bay
Volksrust
Wakkerstroom
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SCALE
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Eleanora Hofer 1972

## OUTLINE MAP OF SOUTHERN AFRICA

Indicating localities of Aloeides spp. recorded from South Africa and some adjoining areas.

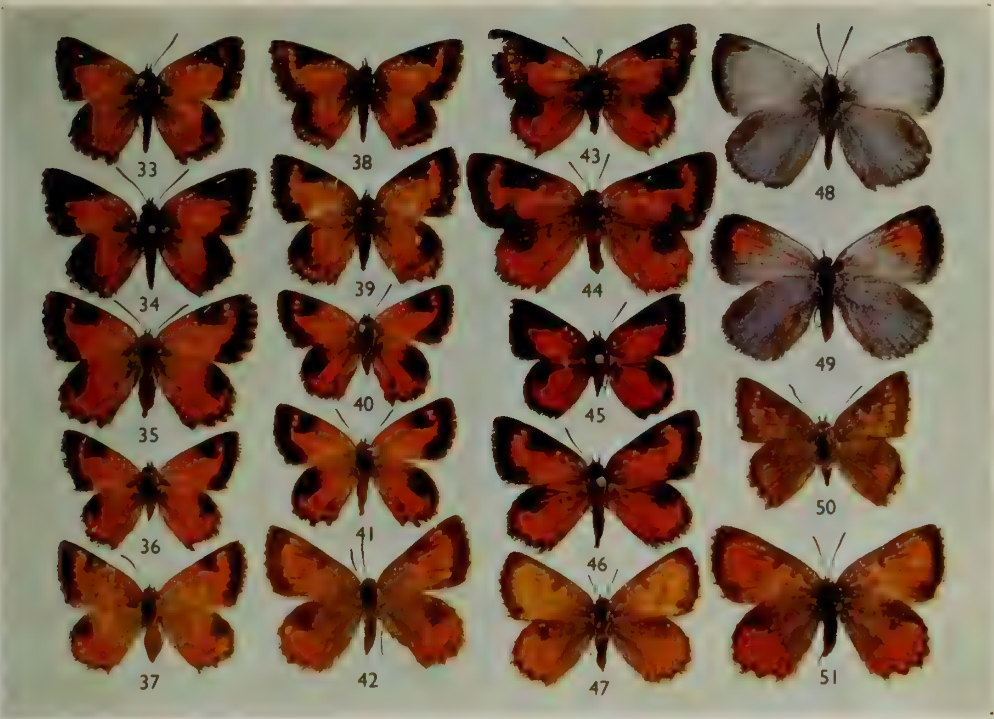
## PLATE 1

### Uppersides

FIG. 33. *Aloeides molomo molomo* ♂ (Johannesburg)
FIG. 34. *A. molomo molomo* ♂ (Johannesburg)
FIG. 35. *A. molomo molomo* ♀ (Johannesburg)
FIG. 36. *A. molomo krooni* ♂, holotype (Kuruman)
FIG. 37. *A. molomo krooni* ♀, allotype (Kuruman)
FIG. 38. *A. molomo coalescens* ♂, holotype (Umtali)
FIG. 39. *A. molomo coalescens* ♀, allotype (Umtali)
FIG. 40. *A. molomo mumbuensis* ♂, holotype (Mumbwa)
FIG. 41. *A. molomo mumbuensis* ♀, allotype (Mumbwa)
FIG. 42. *A. conradsi jacksoni* ♀, allotype (Nairobi)
FIG. 43. *A. molomo kiellandi* ♂, holotype (Mpanda)
FIG. 44. *A. molomo kiellandi* ♀, allotype (Mpanda)
FIG. 45. *A. molomo handmani* ♂ (Ncheu)
FIG. 46. *A. molomo handmani* ♀ (Ncheu)
FIG. 47. *A. conradsi talboti* ♀, allotype (Ngorongoro Crater)
FIG. 48. *A. barklyi* ♂ (Kamieskroon)
FIG. 49. *A. barklyi* ♀ (Kamieskroon)
FIG. 50. *A. conradsi conradsi* ♂ (Ukerewe)
FIG. 51. *A. conradsi conradsi* ♀ (Ukerewe)

### Undersides

FIG. 52. *Aloeides molomo molomo* ♂ (Johannesburg)
FIG. 53. *A. molomo molomo* ♂ (Johannesburg)
FIG. 54. *A. molomo molomo* ♀ (Johannesburg)
FIG. 55. *A. molomo krooni* ♂, holotype (Kuruman)
FIG. 56. *A. molomo krooni* ♀, allotype (Kuruman)
FIG. 57. *A. molomo coalescens* ♂, holotype (Umtali)
FIG. 58. *A. molomo coalescens* ♀, allotype (Umtali)
FIG. 59. *A. molomo mumbuensis* ♂, holotype (Mumbwa)
FIG. 60. *A. molomo mumbuensis* ♀, allotype (Mumbwa)
FIG. 61. *A. conradsi jacksoni* ♀, allotype (Nairobi)
FIG. 62. *A. molomo kiellandi* ♂, holotype (Mpanda)
FIG. 63. *A. molomo kiellandi* ♀, allotype (Mpanda)
FIG. 64. *A. molomo handmani* ♂ (Ncheu)
FIG. 65. *A. molomo handmani* ♀ (Ncheu)
FIG. 66. *A. conradsi talboti* ♀, allotype (Ngorongoro Crater)
FIG. 67. *A. barklyi* ♂ (Kamieskroon)
FIG. 68. *A. barklyi* ♀ (Kamieskroon)
FIG. 69. *A. conradsi conradsi* ♂ (Ukerewe)
FIG. 70. *A. conradsi conradsi* ♀ (Ukerewe)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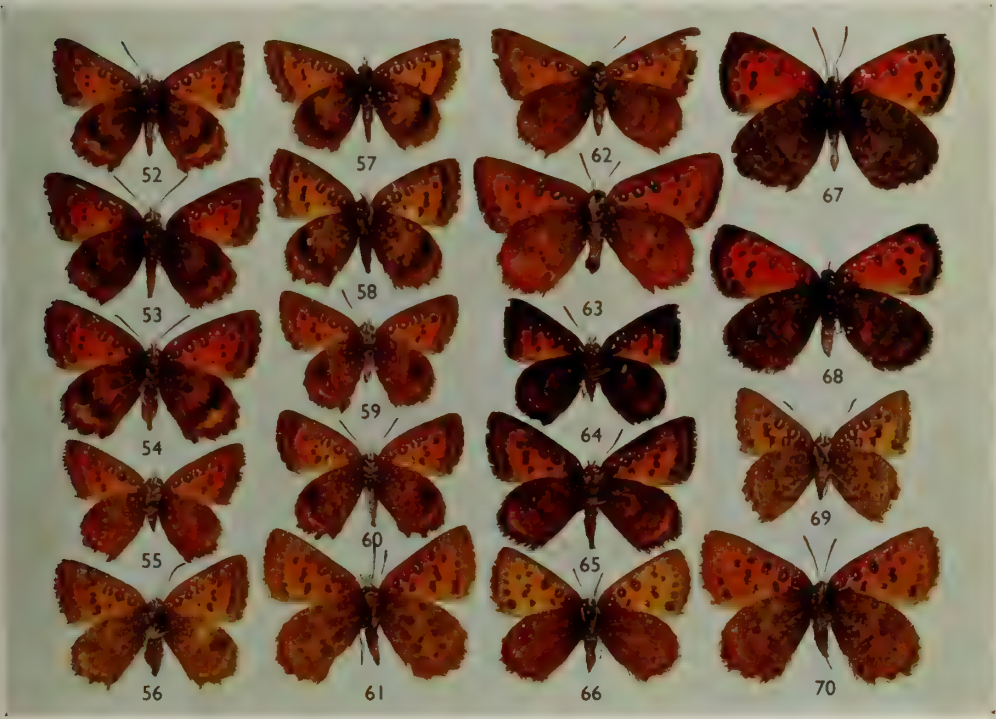
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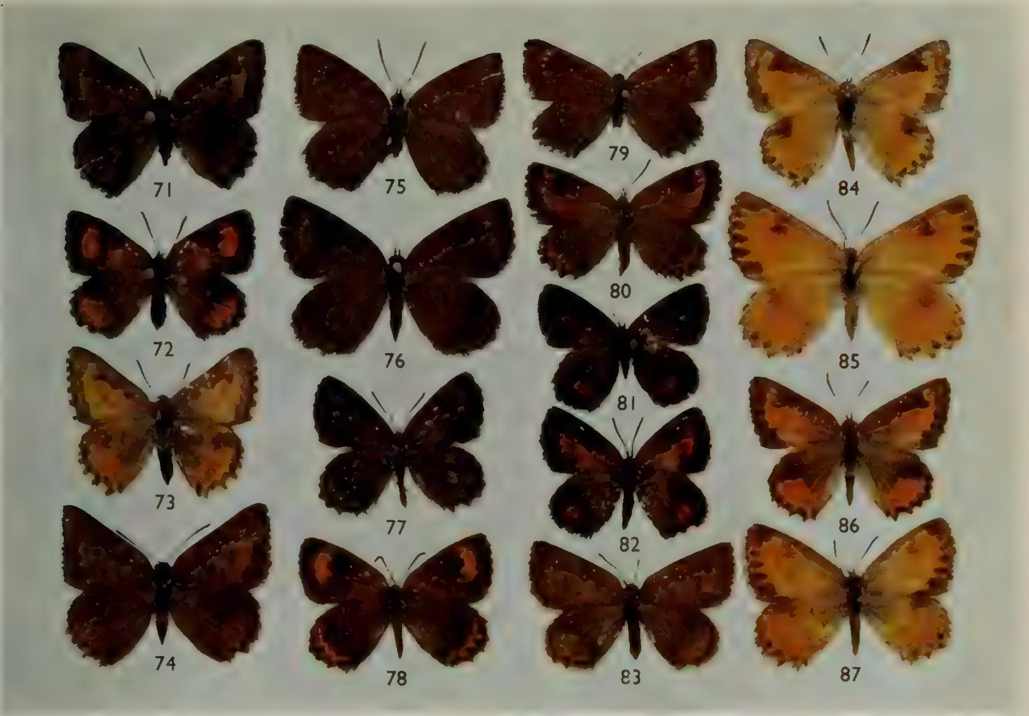
## PLATE 2

### Uppersides

Fig. 71. *Aloeides conradsi angoniensis* ♂ (Ncheu)
Fig. 72. *A. conradsi angoniensis* ♀ (Ncheu)
Fig. 73. *A. conradsi* f. *ochraceoa* ♂, holotype (District of Great Craters)
Fig. 74. *A. angolensis* ♂, holotype (Benguella)
Fig. 75. *A. griseus* ♂, holotype (Solwezi)
Fig. 76. *A. griseus* ♀, allotype (Solwezi)
Fig. 77. *A. taikosama* ♂ (Muden)
Fig. 78. *A. taikosama* ♀ (Weenen)
Fig. 79. *A. plowesi* ♂, holotype (Salisbury)
Fig. 80. *A. plowesi* ♀, allotype (Salisbury)
Fig. 81. *A. susanae* ♂, holotype (Muden)
Fig. 82. *A. susanae* ♀, allotype (Muden)
Fig. 83. *A. angolensis* ♀, allotype (Benguella)
Fig. 84. *A. damarensis damarensis* ♂ (Okahandja)
Fig. 85. *A. damarensis damarensis* ♀ (Okahandja)
Fig. 86. *A. damarensis mashona* ♂, holotype (Bulawayo)
Fig. 87. *A. damarensis mashona* ♀, allotype (Salisbury)

### Undersides

Fig. 88. *Aloeides conradsi angoniensis* ♂ (Ncheu)
Fig. 89. *A. conradsi angoniensis* ♀ (Ncheu)
Fig. 90. *A. conradsi* f. *ochraceoa* ♂, holotype (District of Great Craters)
Fig. 91. *A. angolensis* ♂, holotype (Benguella)
Fig. 92. *A. griseus* ♂, holotype (Solwezi)
Fig. 93. *A. griseus* ♀, allotype (Solwezi)
Fig. 94. *A. taikosama* ♂ (Muden)
Fig. 95. *A. taikosama* ♀ (Weenen)
Fig. 96. *A. plowesi* ♂, holotype (Salisbury)
Fig. 97. *A. plowesi* ♀, allotype (Salisbury)
Fig. 98. *A. susanae* ♂, holotype (Muden)
Fig. 99. *A. susanae* ♀, allotype (Muden)
Fig. 100. *A. angolensis* ♀, allotype (Benguella)
Fig. 101. *A. damarensis damarensis* ♂ (Okahandja)
Fig. 102. *A. damarensis damarensis* ♀ (Okahandja)
Fig. 103. *A. damarensis mashona* ♂, holotype (Bulawayo)
Fig. 104. *A. damarensis mashona* ♀, allotype (Salisbury)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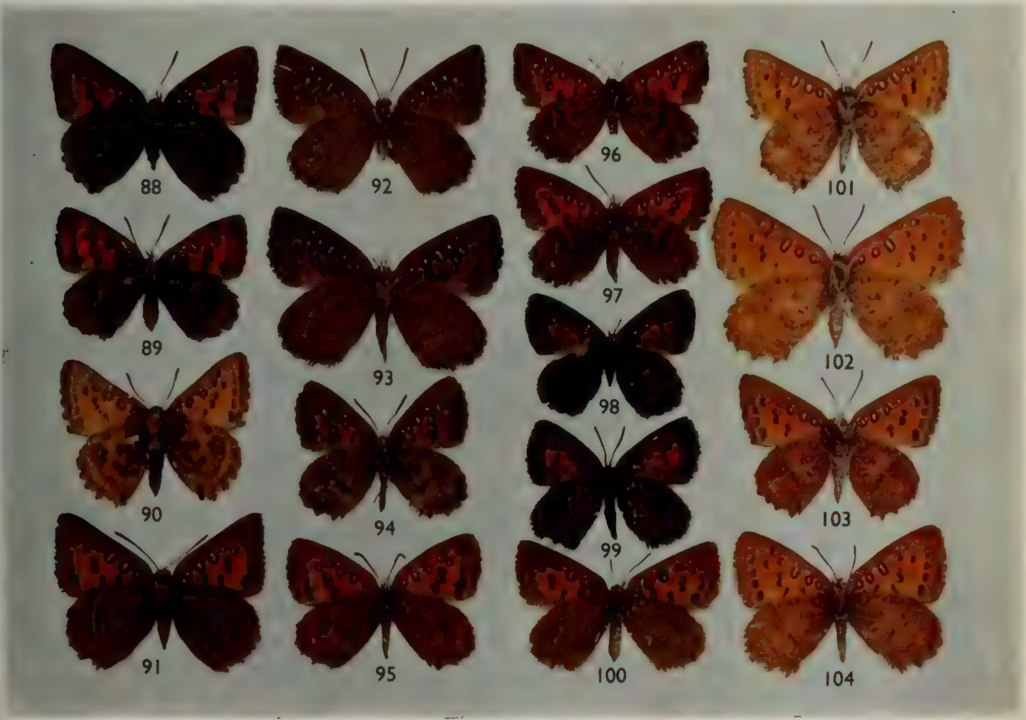
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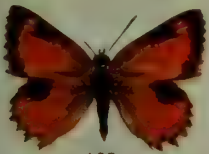
# PLATE 3

## Uppersides

Fig. 105. *Aloeides damarensis damarensis* ♂ (Cradock)
Fig. 106. *A. damarensis damarensis* ♀ (Cradock)
Fig. 107. *A. damarensis damarensis* ♀ (Cradock)
Fig. 108. *A. stevensoni* ♂ holotype (Rusape)
Fig. 109. *A. trimeni southeyae* ♂, holotype (near Mossel Bay)
Fig. 110. *A. pierus* ♂ (Cape Town)
Fig. 111. *A. pierus* ♀ (Cape Town)
Fig. 112. *A. pierus* ♀ (Cape Town)
Fig. 113. *A. trimeni trimeni* ♂, holotype (Witpoortjie)
Fig. 114. *A. trimeni trimeni* ♀, allotype (Witpoortjie)
Fig. 115. *A. trimeni trimeni* ♂ (Witpoortjie)
Fig. 116. *A. trimeni trimeni* ♂ (Estcourt)
Fig. 117. *A. trimeni trimeni* ♀ (Estcourt)
Fig. 118. *A. swanepoeli* ♂, holotype (Botha's Hill)
Fig. 119. *A. swanepoeli* ♀, allotype (Botha's Hill)
Fig. 120. *A. aranda* f. ♂ (Muzi Forest)
Fig. 121. *A. aranda* f. ♀ (Muzi Forest)

## Undersides

Fig. 122. *Aloeides damarensis damarensis* ♂ (Cradock)
Fig. 123. *A. damarensis damarensis* ♀ (Cradock)
Fig. 124. *A. damarensis damarensis* ♀ (Cradock)
Fig. 125. *A. stevensoni* ♂ holotype (Rusape)
Fig. 126. *A. trimeni southeyae* ♂, holotype (near Mossel Bay)
Fig. 127. *A. pierus* ♂ (Cape Town)
Fig. 128. *A. pierus* ♀ (Cape Town)
Fig. 129. *A. pierus* ♀ (Cape Town)
Fig. 130. *A. trimeni trimeni* ♂, holotype (Witpoortjie)
Fig. 131. *A. trimeni trimeni* ♀, allotype (Witpoortjie)
Fig. 132. *A. trimeni trimeni* ♂ (Witpoortjie)
Fig. 133. *A. trimeni trimeni* ♂ (Estcourt)
Fig. 134. *A. trimeni trimeni* ♀ (Estcourt)
Fig. 135. *A. swanepoeli* ♂, holotype (Botha's Hill)
Fig. 136. *A. swanepoeli* ♀, allotype (Botha's Hill)
Fig. 137. *A. aranda* f. ♂ (Muzi Forest)
Fig. 138. *A. aranda* f. ♀ (Muzi Forest)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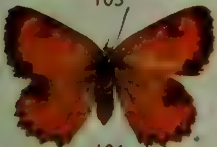
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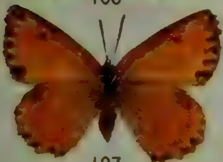
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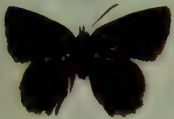
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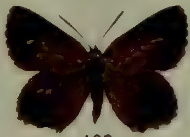
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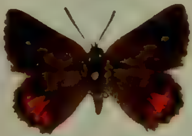
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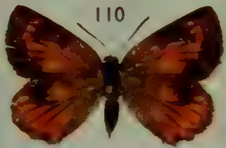
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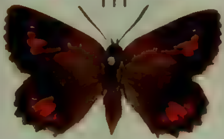
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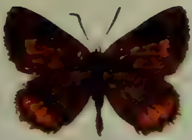
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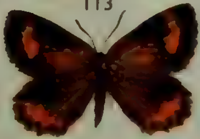
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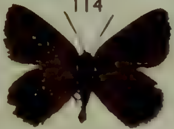
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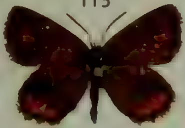
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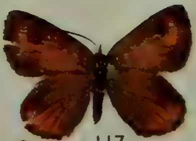
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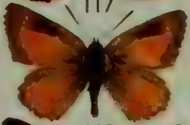
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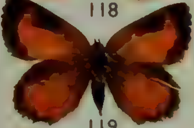
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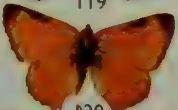
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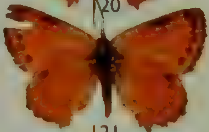
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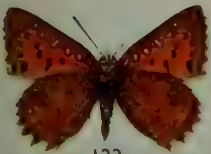
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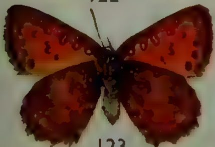
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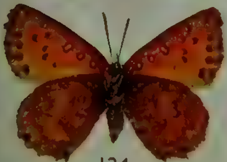
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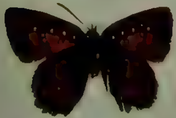
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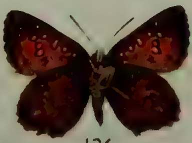
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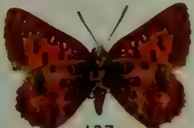
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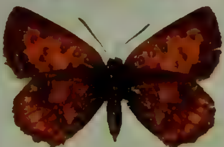
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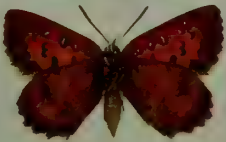
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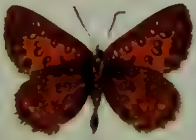
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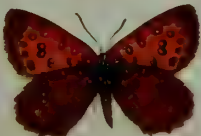
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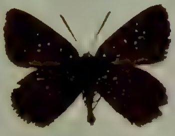
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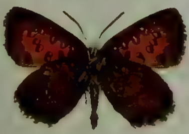
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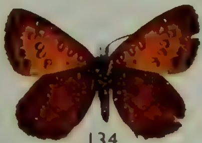
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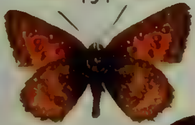
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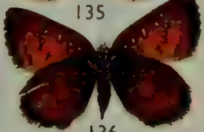
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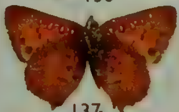
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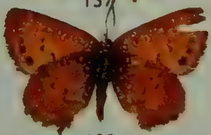
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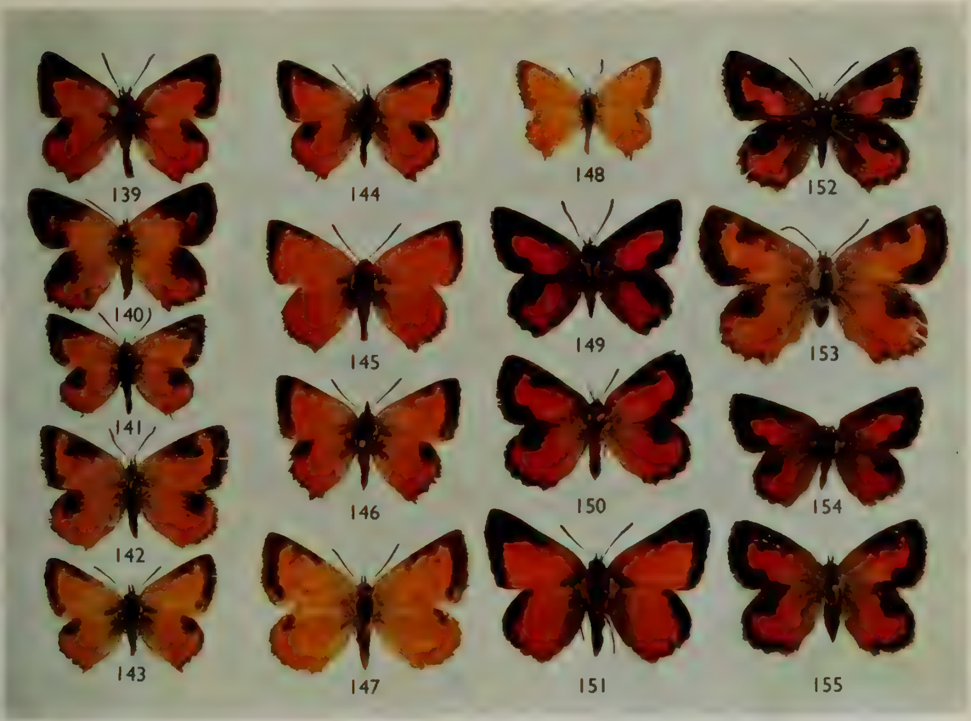
# PLATE 4

## Uppersides

Fig. 139. *Aloeides aranda* ♂ (Simonstown)
Fig. 140. *A. aranda* ♀ (Simonstown)
Fig. 141. *A. aranda* ♂ (Witpoortjie)
Fig. 142. *A. aranda* ♀ (Witpoortjie)
Fig. 143. *A. aranda* ♂ (Estcourt)
Fig. 144. *A. aranda* f. *rougemonti* ♂ (Zoutpansberg)
Fig. 145. *A. aranda* f. *zilka* ♂ (Inyanga)
Fig. 146. *A. aranda* f. *marshalli* ♂ (Vumba Mts)
Fig. 147. *A. aranda* f. *marshalli* ♀ (Inyanga)
Fig. 148. *A. aranda* f. ♂ (Delagoa Bay)
Fig. 149. *A. henningi* ♂, holotype (Struben's Valley)
Fig. 150. *A. henningi* ♀, allotype (Struben's Valley)
Fig. 151. *A. caledoni* ♂, holotype (Shaw's Mountain)
Fig. 152. *A. macmasteri* ♂ (Eastpoort)
Fig. 153. *A. macmasteri* ♀ (Eastpoort)
Fig. 154. *A. almeida* ♂, holotype ('Cap')
Fig. 155. *A. almeida* ♀ (Knysna)

## Undersides

Fig. 156. *Aloeides aranda* ♂ (Simonstown)
Fig. 157. *A. aranda* ♀ (Simonstown)
Fig. 158. *A. aranda* ♂ (Witpoortjie)
Fig. 159. *A. aranda* ♀ (Witpoortjie)
Fig. 160. *A. aranda* ♂ (Estcourt)
Fig. 161. *A. aranda* f. *rougemonti* ♂ (Zoutpansberg)
Fig. 162. *A. aranda* f. *zilka* ♂ (Inyanga)
Fig. 163. *A. aranda* f. *marshalli* ♂ (Vumba Mts)
Fig. 164. *A. aranda* f. *marshalli* ♀ (Inyanga)
Fig. 165. *A. aranda* f. ♂ (Delagoa Bay)
Fig. 166. *A. henningi* ♂, holotype (Struben's Valley)
Fig. 167. *A. henningi* ♀, allotype (Struben's Valley)
Fig. 168. *A. caledoni* ♂, holotype (Shaw's Mountain)
Fig. 169. *A. macmasteri* ♂ (Eastpoort)
Fig. 170. *A. macmasteri* ♀ (Eastpoort)
Fig. 171. *A. almeida* ♂, holotype ('Cap')
Fig. 172. *A. almeida* ♀ (Knysna)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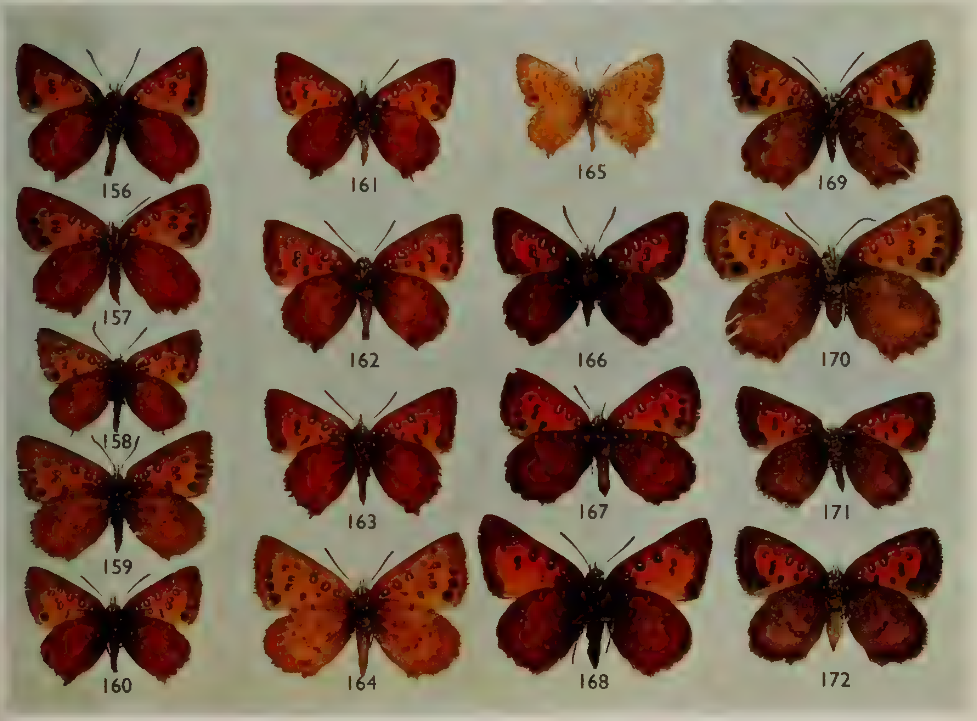
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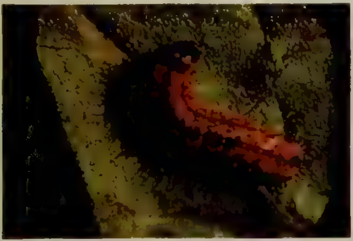
## PLATE 5

### Life Histories

FIG. 173. *Aloeides dentatis*, larva, 2nd instar.
FIG. 174. *A. dentatis*, larva, 3rd instar.
FIG. 175. *A. dentatis*, larva, penultimate instar.
FIG. 176. *A. dentatis*, larva, final instar.
FIG. 177. *A. dentatis*, pupa, and ant (*Camponotus* sp.) from the same nest
FIG. 178. *A. trimeni*, larva, 1st instar.
FIG. 179. *A. trimeni*, larva, 3rd instar.
FIG. 180. *A. trimeni*, larva, 4th instar.
FIG. 181. *A. trimeni*, larva, 5th instar.
FIG. 182. *A. dentatis*, imago, freshly emerged (22.ii.1971)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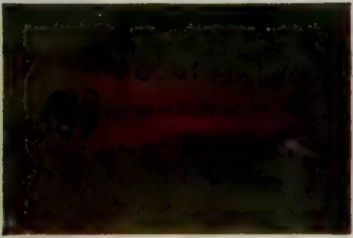
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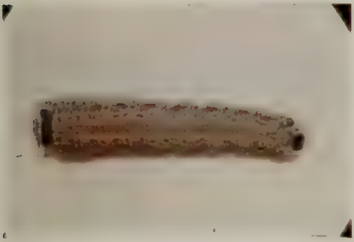
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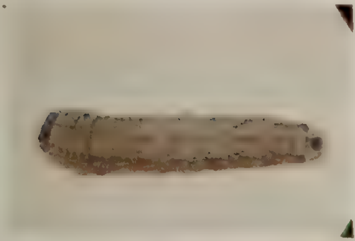
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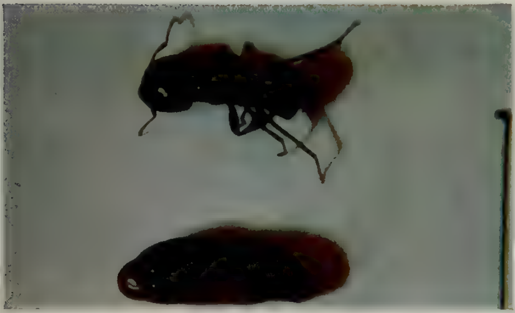

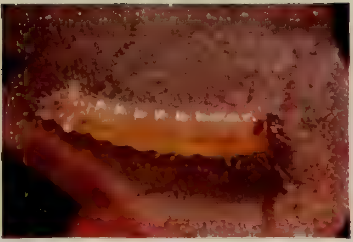
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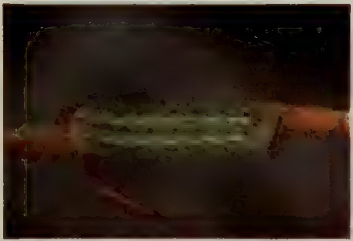
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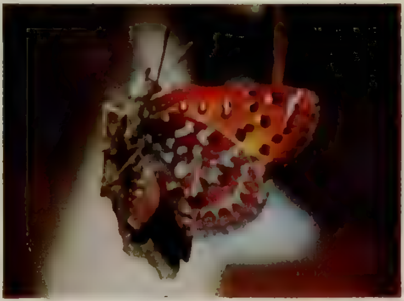

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C. F. COWAN

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
ENTOMOLOGY Vol. 29 No. 6
LONDON : 1974

BRITISH MUSEUM [illegible] NATURAL HISTORY

# THE INDO-ORIENTAL GENUS *DRUPADIA* MOORE (LEPIDOPTERA : LYCAENIDAE)

BY

CHARLES FRANCIS COWAN
Little Gaddesden House, Berkhamsted, Hertfordshire

*Pp.* 281–356; 6 *Plates*, 15 *Text-figures*

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# THE INDO-ORIENTAL GENUS *DRUPADIA* MOORE (LEPIDOPTERA : LYCAENIDAE)

*By* C. F. COWAN

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## SYNOPSIS

Fifteen species are placed in the genus *Drupadia* Moore, 1884, which until recently has wrongly been referred to as *Marmessus*. Centred on Borneo, they range to Sumatra, Burma and Vietnam, with outliers in Sikkim, Java, Sulawesi and the Philippines. All named forms are discussed, and keys are provided to the species and subspecies. Two new species from Borneo and nine new geographical subspecies are described, including four for *Drupadia rufotaenia* (Fruhstorfer) which more than double its known range. One preoccupied name is replaced. All species are illustrated, as are the male genitalia of the thirteen whose males are known. Cross-references are given to the illustrations of Seitz (1926) and a systematic list is appended.

## INTRODUCTION

IT WAS forecast (Cowan, 1966 *a* : 105)[1] that the species here dealt with would be treated as a tribe, the 'Marmessini', as distinct from the Horagini and the Cheritrini which tribes I wrongly claimed as new. However, after discussion with Lt-Col. J. N. Eliot (*in litt.*), whose reclassification of the world Lycaenidae is now in press, I agree that they should comprise the genus *Drupadia* Moore, as a member of the Cheritrini. The name *Marmessus* Hübner is not applicable to Lycaenidae (Cowan, 1966 *b*).

---

[1] Opportunity is taken here to note that I attributed (Cowan, 1966 *a* : 109, 136 last line) the name *Papilio triopas* to Cramer. The author was Stoll. The tribal names were introduced as follows; Horagini Swinhoe, [September] 1911 (and Moulton, December 1911 as Horagaria), and Cheritrini (Cheritraria) Moulton, December 1911 (and Swinhoe, [March] 1912). Earlier, Swinhoe, 1910 (**8** : 11) listed both these names but without either diagnosis or included genera. I omitted two figure references in 1966; on page 124 for *Horaga samoena* Grose-Smith, insert Grose-Smith, 1902 (Oriental Lycaenidae): 14, pl. 25, figs 11, 12, and on page 134 for *Horaga selina* Grose-Smith, insert Grose-Smith, 1902 (Oriental Lycaenidae): 15, pl. 25, figs 14, 15. Furthermore, *Horaga onyx* Moore, [1858] and *Ticherra acte* Moore, [1858] should be so dated and not 1857.

Finally (Cowan, 1967 : 95), the locality Liwa (? Miva) was in doubt. Although found on no other maps up to a scale of 1/1 million, it is boldly marked on map 20 of Macmillan, 1964, *Atlas of south east Asia* (92 pp., 4°. London & New York). Liwa is 5°03′S., 104°11′E., at the head of the valley about 30 kilometres north east of Krui. My quotation came from Doherty's Diary, of which extracts were published by Hartert, 1901 : 498, and 'Miva' must, as suggested, have been a transcription error.

## ABBREVIATIONS

The material here examined is all in the National Collection at the British Museum (Natural History), London, unless otherwise stated. Where reference to this collection is necessary, the abbreviation BMNH is used. Other collections are named in full, preceded where appropriate by the abbreviation 'coll.'

## ACKNOWLEDGEMENTS

This study was commenced in 1954, when the National Collection was still divided between the BMNH in London and the Rothschild Museum at Tring, and Mr N. D. Riley, C.B.E., then Keeper of Entomology, most generously allowed me the privilege of bringing the specimens together for the first time. His ready help, and the assistance of Mr G. E. Tite at Tring, and Mr N. H. Bennett and Mr T. G. Howarth, B.E.M., in London, were invaluable.

Army service prevented progress for ten years. When I retired at the end of 1964 to stay near Tring, both Mr Tite and Mr Bennett were there, with all the Lycaenidae and the magnificent Rothschild Library. Mr J. P. Doncaster, C.B.E., the new Keeper, allowed me to enjoy all facilities there, and the Horagini and Cheritrini were dealt with.

Further delay with problems of nomenclature and bibliography supervened; then Mr Tite and Mr Bennett retired, all the insects and books were removed to London, the Museum was demolished, rebuilt and rearranged, and the whole Sub-department of Ornithology, under Dr D. W. Snow, occupied the premises. By now Dr P. Freeman had taken over as Keeper of Entomology, and he and Dr Snow most kindly arranged for me to remain at a table at Tring with the *Drupadia* collection, to complete this paper. During the transition, Miss Susan May was constantly helpful.

Meanwhile loans of specimens had accumulated. First, a paratype sent by the Director of the Rijksmuseum van Natuurlijke Historie, Leiden, then another from the Sarawak Museum, Kuching, discovered there by Dr G. H. L. Rothschild, and then some select specimens from Col. J. N. Eliot, Mr G. C. Stubbs, Dr T. Norman, and Mr J. A. Hislop, M.C. Next, with the help of Mr E. Taylor, a new species was found in the Hope Collection and an extended loan arranged by kind permission of Dr G. C. Varley, the Hope Professor, University Museum, Oxford. Finally, in a small collection made by Capt. J. Smeaton Stuart, no less than four fresh specimens of another unnamed species were found, which he kindly presented to the collection.

To all these, for their valued advice and ready help, and for their patience, I

would like to express my warmest gratitude, and to add my sincere apologies for the time taken to produce a result.

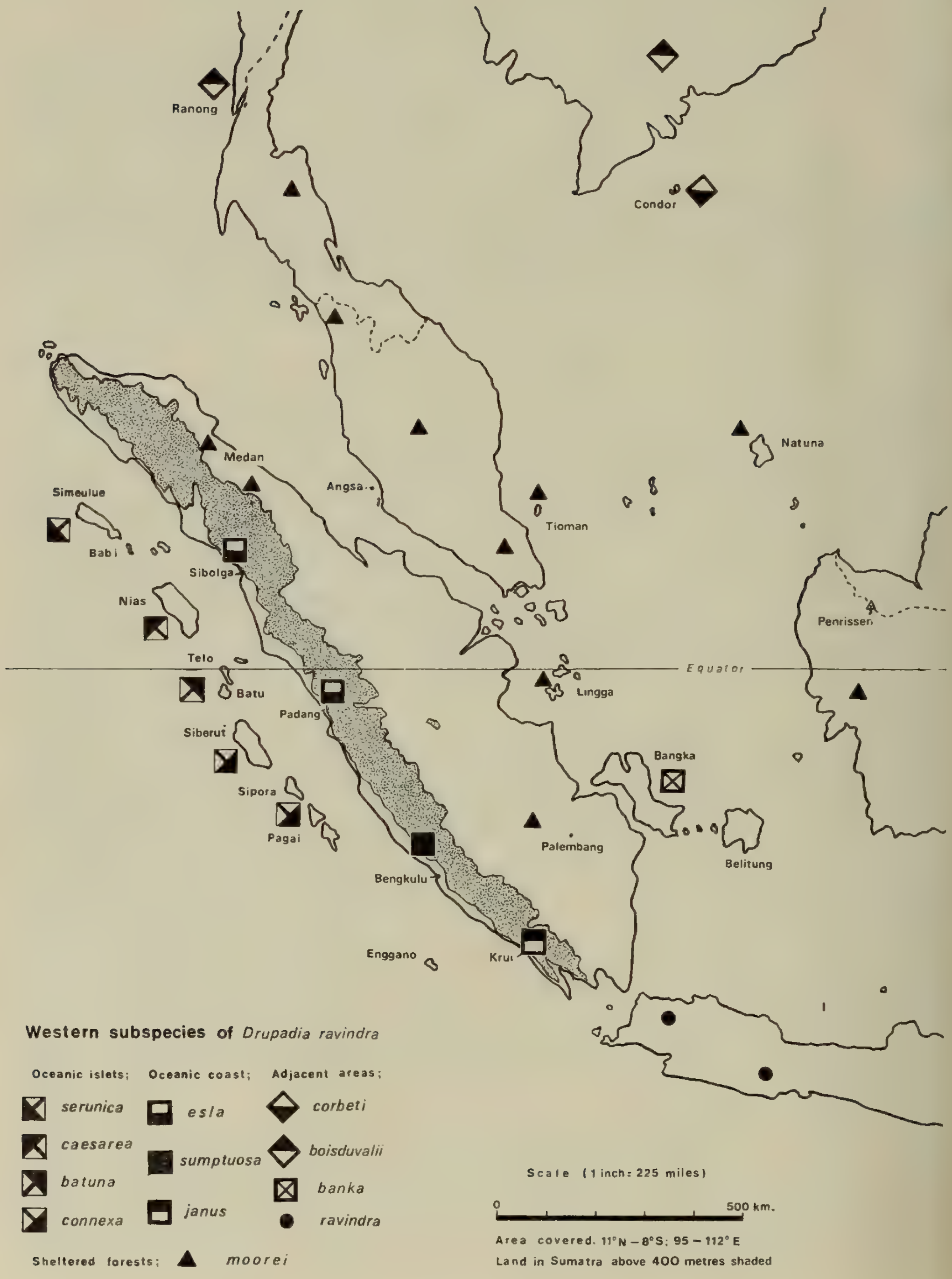
## TOPOGRAPHICAL NOTES: SUMATRA AND BORNEO

The area occupied by *Drupadia* is compact. Five species are known only from Borneo – Kalimantan, two only from Sumatra and the Malaysian Peninsula, and one only from Thailand – Vietnam. These countries, together with Burma, have a further six species in common, one of which penetrates north-west to Sikkim and four south-east to the Philippines. One of the last four reaches Java and another Sulawesi. The fifteenth species is known only as an unique female from a small island in the Straits of Malacca. A surprising feature of the distribution is that, although well established in Sumatra and the islands west of it, none of the genus is found in the well collected Nicobar and Andaman Islands in the north. Perhaps as remarkable is that only one species is reliably known from Java.

Sumatra and Borneo, two of the largest six islands in the world, and both bisected by the equator, are of great interest in studying this genus. Sumatra (Text-fig. 1) stretches over 1000 miles along the edge of the Indian Ocean, from which it rises steeply throughout its length in the folded Barisan mountain range, with its many peaks above 3000 metres high. Beyond that range it drops to a long, low-lying plain. Its orientation from north-west to south-east leads to some difficulty in locality description, one recent paper touching on the genus placing Krui, best described as in the south or south-west, as being in 'west Sumatra' on one page and in 'south east Sumatra' on the facing page. Too often, the inadequate 'Sumatra' has been given as a locality, and careful recording is essential.

The main features and few collected localities of Sumatra, and the oceanic islets west of it, are shown in Text-fig. 1. Knowledge of the west coast leaves much to be desired. Raffles's great collections were lost at sea in 1824. Horsfield concentrated on Java (but see below, p. 306) and little else was done there in the next sixty years. Wallace virtually ignored the island, making a brief excursion from Palembang at the end of his tour. Then Kheil (1884) made Nias a fashionable collecting ground after his three-year sojurn there, and only recently has attention been turned to the other islands. Martin lived at Medan in the north-east, and his home drew most of the other collectors, notably de Nicéville (butterflies) and Hartert (birds). These all confined their activities to the north-east sector, with excursions into the eastern slopes of the Battack mountains, the local portion of the Barisan range. Thus the west coast of Sumatra, the most interesting part, has been largely neglected.

Also shown in Text-fig. 1 are the subspecies of *Drupadia ravindra* (Horsfield) so far known from Sumatra. They are exceptionally well differentiated, and seven occur in the western slopes and islets. By contrast, on crossing the watershed, the entire inland plain appears to be populated by the same subspecies as flies throughout peninsular Malaya and much of west and north Borneo-Kalimantan.



Western subspecies of *Drupadia ravindra*

Ranong
Condor
Medan
Angsa
Natuna
Tioman
Simeulue
Babi
Sibolga
Nias
Penrissen
Telo
Equator
Batu
Lingga
Padang
Siberut
Bangka
Sipora
Pagai
Palembang
Belitung
Bengkulu
Enggano
Krui
Oceanic islets;
serunica
caesarea
batuna
connexa
Oceanic coast;
esla
sumptuosa
janus
Adjacent areas;
corbeti
boisduvalii
banka
ravindra
Sheltered forests;
moorei
Scale (1 inch: 225 miles)
0
500 km.
Area covered. 11°N – 8°S; 95 – 112° E
Land in Sumatra above 400 metres shaded

Sumatra has no peculiar species. Its interest lies purely in the marked subspeciation along its oceanic strip.

Borneo-Kalimantan is quite the opposite. No less than five of the fifteen species here discussed are peculiar to it, and whereas at least four different subspecies of *D. ravindra* fly there, their territories intermingle and three of them radiate to neighbouring countries. This island is mainly low lying, with hills more gradual and more evenly distributed than those of Sumatra. Its remote hinterland appears to be both a clinocentre for subspeciation and a reservoir for the development of obscure species.

Modern improved means of access may afford fuller material and fresh knowledge. This should result in considerable deductions on the evolution not only of the species but also of the region itself.

## SEITZ REFERENCES

At least a third of the species and subspecies are illustrated in colour by Seitz, and, as his work is generally available and almost universally consulted, full references are given in all cases. Owing to Fruhstorfer's untimely death in April 1922, Seitz himself had to compile the relevant section of the text from his notes four years later. This inevitably led to a few unfortunate mistakes, which are pointed out.

Even so, the errors cannot all be so excused. While the text did not appear until 1926 (which date is here cited throughout), the plates, on which all figures are named, for all the Lycaenidae (pls 141–162) except two (pls 146B, 150B) had been published by June 1922, and Fruhstorfer must have seen them in preparation. The plates applicable to *Drupadia*, and the month in which each was published, are: pl. 146 (May 1915), 147 (November 1921), 156, 158 (February 1922), 159 (May 1922) and 146B (November 1927).

## ***DRUPADIA*** Moore, 1884

*Drupadia* Moore, (30 June) 1884 : 31. Type-species: *Myrina* [*Thecla*] *ravindra* Horsfield, by original designation.

*Drupadia* (Moore ms.) Distant, (August) 1884 : 233, 236. Type-species: *Myrina* [*Thecla*] *ravindra* Horsfield, by original (: 237) designation.

*Biduanda* Distant, (August) 1884 : 233, 233n., 237. Type-species: *Myrina thesmia* Hewitson, by original designation. [Subjective synonym.]

[*Marmessus* Hübner; Nicéville, 1890 : 429n. Type-species: *Papilio lisias* Cramer, by subsequent designation (Scudder, 1875 : 212). Misapplication.]

*Drupada* Moore; Piepers, 1918 : 105. [Erroneous spelling.]

The name *Marmessus* Hübner was incorrectly introduced and widely used from 1890 onwards. Its type-species, *Papilio lisias* Cramer, is a neotropical Riodinid.

---

FIG. 1. Sumatra; to show the oceanic coast and offshore islets, the manifold Barisan Range, the sheltered lowlands, and the main collected localities; with neighbouring lands and some key place names.

It did not include *P. lisias* Fabricius, which is a subjective synonym of *Thecla ravindra* Horsfield (*v.* Cowan, 1966 *b*).

*Biduanda*, whose type-species possesses fore wing vein 9, and *Drupadia* (or '*Marmessus*') which lacks it, were both employed for separate genera until Riley (1942 : 88) synonymised them, as occasional individuals of *D. ravindra* do possess vein 9 and confusion had arisen because they had been described as new species of *Biduanda*. The latter name remains available should it ever be required.

External characteristics. *Drupadia* has the same head and antennae, smooth eyes, and palpi with smoothly adpressed scales and naked, long porrect third segment, as in *Cheritra*.

The wings (Text-figs 2–11, the veins numbered as in Text-fig. 10) have the cells slightly longer than both *Cheritra* and *Horaga*, being at least half as long as the costa. The hind wing tail at vein 2 is shorter than in *Cheritra*, *Eooxylides* and *Neomyrina*, being never longer than the costa. The shorter tails at veins 1 and 3 are as in *Cheritra*, although that at vein 3 may be reduced. The tails differ from those of *Horaga* in being more robust, ciliate laterally, and white with a black centre instead of black with a white ciliate apex.

The fore wing differs from *Cheritra* in having vein 9, when present, very short, its origin well beyond the end of vein 10 instead of at or before it. In *abnormis* female (Text-fig. 4, male unknown) vein 5 originates close to vein 6 (as in *Neomyrina*), instead of midway between veins 4 and 6. In many species the male dorsum is strongly lobed in the basal two-thirds.

The hind wing veins are as in *Cheritra*. Males of several species, however, have the costa lobed near the base, and vein 8 short. This is particularly evident in *cineas* (Text-fig. 9).

Male insignia are found in variety, from none at all up to three together of the following, according to species.

Fore wing underside with a dorsal fringe – *cinderella*
Fore wing upperside with a discal 'brand' – *cinesoides*
Fore wing underside with a dorsal 'brand' – *achaja*, *ravindra*, *cineas*, *cinesia*, *cinesoides*
Hind wing upperside with a sub-basal 'brand' – the above six, plus *theda*, *scaeva*

There are none in the remaining five of the thirteen species whose males are known. The considerable variety suggests that some of the species have evolved over a long period. Insignia are undoubtedly connected with courtship, and thus are essentially diagnostic of species and only occasionally and incidentally indicative

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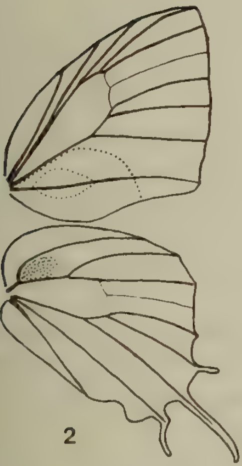
Figs 2–11. Wing diagrams of *Drupadia* males (4, 8, females).

2, *ravindra*; 3, *theda*; 4, *abnormis* ♀; 5, *achaja*; 6, *cinderella*; 7, *scaeva*; 8, *araotina* ♀; 9, *cineas*; 10, *cinesia* (showing notation); 11, *cinesoides*.

Notes. Sexual insignia shown on the fore wing disc and on the hind wing are on the uppersides; those on the fore wing dorsum, including the fringe on *cinderella*, are on the undersides. Scale: approximately twice natural size.



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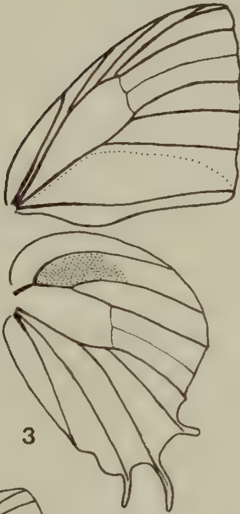

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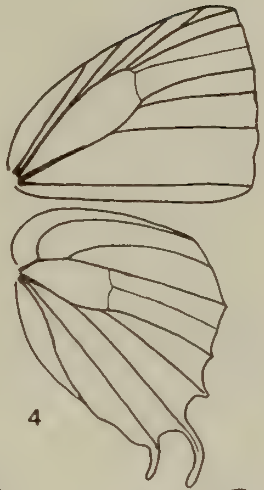

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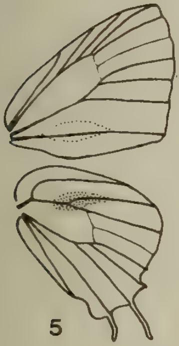

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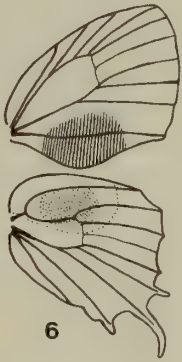

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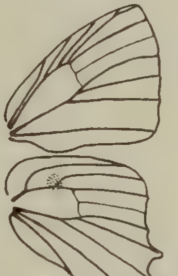

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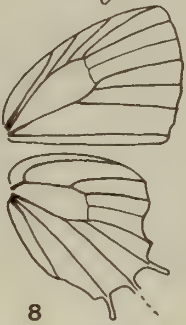

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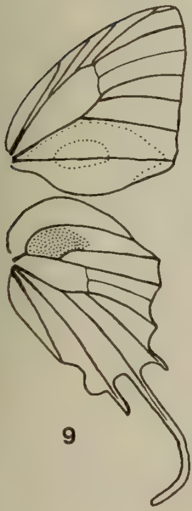

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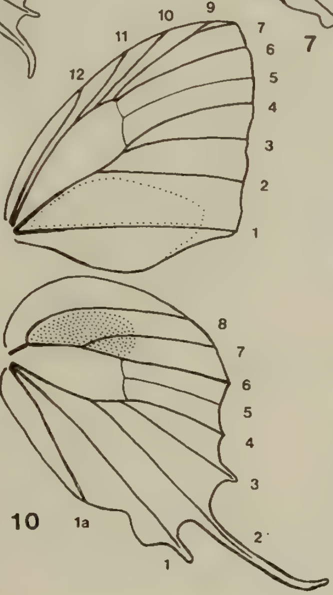
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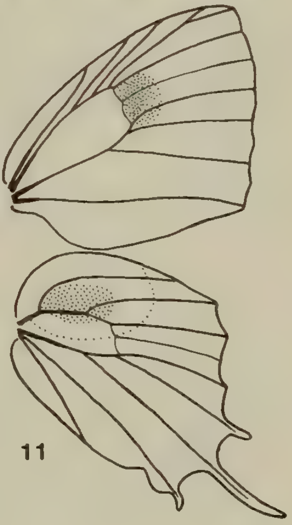


11

of genus. They are usually explained as scent holders or diffusers. I have for long associated the fore wing discal 'brand' (familiar in Strymonidi) with the antennal club, which can be brought into contact with it when the wings are closed. This 'brand' may be for polishing, scenting, powdering, or even electrifying the antennae, possibly of the courted female but more probably of the suitor male. Although I have found no favour for these ideas, no plausible alternatives have been offered. Field studies of courtship behaviour in Lycaenidae are most desirable.

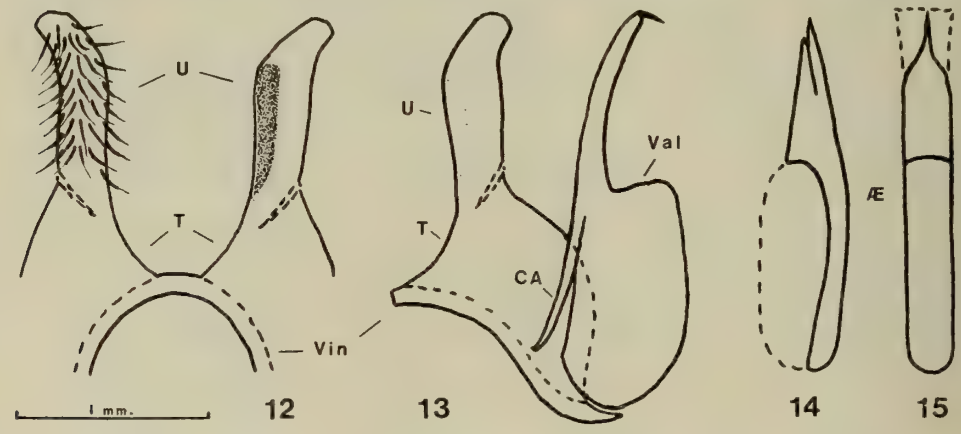
MALE GENITALIA (Text-figs 12–15). The male genitalia are unique, and diagnostic for the genus. The *vinculum* (Vin) forms a complete, very narrow ring, dorsally free as a narrow bridge, laterally fused to the twin halves of the tegumen, and ventrally flattened and upturned like a saddle. This saddle is presumably a modification of the saccus.

The distinctive *tegumen* (T) is separated into two triangular halves, each bearing apically an elongate digital half *uncus* (U), which is more (in *rufotaenia*) or less hirsute and is marked on its dorsal face with a dark brown stigma. Gnathoi and socii are lacking.

The *valvae* (Val) are seated on the vinculum saddle. Each has a large basal sacculus which may be elliptic (as in *rufotaenia*) or triangular, and the costa is extended forward (cephalad) in a *costal arm* (CA) and rearward (caudad) in a long tubular *style* which terminates in a peculiar down-turned spicule. The proximal arch of the saddle and the bases of the valvae, assisted by the costal arms, apparently replace the absent juxta.

The *aedeagus* (Æ), loosely slung between the costal arms, is apically tapered, sometimes recurved ventrad, and contains a vesica which, when fully everted, is of flared cylindric, or campanulate, shape.

The whole apparatus is of very simple appearance and, as Mr Bennett remarked



FIGS 12–15. Male genitalia of *Drupadia rufotaenia*.

12, Ventral aspect of dorsum; 13, Lateral aspect from left of right tegumen, uncus and valva; 14, Aedeagus, lateral aspect; 15, Aedeagus, ventral aspect. U, uncus; T, tegumen; Vin, vinculum; Val, valva; CA, costal arm; Æ, aedeagus.

on seeing the first, it is sometimes difficult to tell 'which way round it goes'. The thirteen known species are illustrated on Pls 5, 6, at approximately the same scale as was used for the Horagini (Cowan, 1966 *a*), but one third less than that used for the Cheritrini (Cowan, 1967), with their comparatively tiny equipment. Terms italicised above are used in the text below.

GENERIC DIAGNOSIS. The diagnostic characters of the genus are, primarily, the unique structure of the male genitalia; the narrow vinculum and the split tegumen and uncus. Externally, it may be identified by the absent vein 8 and very short or absent vein 9 of the fore wing, and the medium length of the tail at vein 2 of the hind wing.

DISCUSSION. Certain features of the genus call for comment. First, its varied composition. Two species are included, *araotina* and *abnormis*, of which only females are yet known. Their undersides have striking similarities (Pl. 2, figs 45, 51). They appear best placed here at present, but the latter, so well named and with some affinities to *Iraota*, will undoubtedly require a new genus when the male is found. Next, *achaja*, with its monstrous genitalia (Pl. 5, fig. 99) and peculiar minor characters, could almost certainly be separated generically. Its early stages should be interesting. Another isolated and rather anomalous species is *cinesia*, with genitalia (Pl. 6, fig. 111) closest to those of *ravindra* (Pl. 5, fig. 100) but tending, like its pattern, towards *Cheritra*.

Very similar to *cinesia* in appearance, but with the more usual large genitalia, are *cinesoides* and *johorensis*. Another distinctive pair, *cinderella* and *cindi*, superficially recall *Eooxylides* on the underside, but they have less robust tails and other differences. Each of these pairs consists of a larger, sexually dimorphic, species with male insignia, and a smaller species, less dimorphic, in which both sexes resemble the female of the larger.

These pairings recur as a characteristic of most of the genus. The classic example is in *ravindra* and *rufotaenia*; the former twice the size and dimorphic, the latter resembling in both sexes, in each of the varied subspecies, a miniature female of it. Their genitalia (Pl. 5, figs 100, 101) are vastly different in this case, the smaller species carrying twice the armature of the larger. Exactly parallel, except that the genitalia are less distinct, are *theda* and *niasica*. The remaining three species in the genus are *estella* and *scaeva*, a rather anomalous pair, and *cineas* which appears to be solitary.

Finally there is the phenomenon of dwarfs, which occur in both sexes of the dimorphic species. Dwarf females often can be confused with the female of the smaller species of the pair. So can dwarf males, because they lose their dimorphism and their insignia progressively with decrease in size. Again, the best example is *ravindra*, whose normal male upperside (Pl. 1, figs 16–27) has a more or less black fore wing and a blue hind wing. In dwarfs the hind wing becomes progressively darker until in extremes (Pl. 2, fig. 42) only a few shining blue scales remain. At the same time the fore wing lobe and the hind wing brand become obsolete. But the genitalia remain, both in size and shape, unaltered. So an extreme male dwarf, if it can surmount the handicap of lacking insignia, should successfully pair with a normal female of its own species.

Unless this is borne in mind, it is very easy to mistake a dwarf *ravindra* for a *rufotaenia*. Dwarf *theda* may similarly be confused with *niasica*, especially in the Philippines, where the latter is larger than it is elsewhere. In examining the BMNH series of female *D. theda* from the Philippines, several examples of each sex of *D. niasica* were discovered. There is inadequate material to warrant further deductions, and field study is needed. *D. cineas* is an interesting species, affording a complete range of forms, from the large bright blue male with lobed wings to the tiny dark brown dwarfs with no insignia (Pl. 4, figs 85, 86), through all intermediates (fig. 87), while the black and white female (fig. 88) remains unchanged in pattern whatever the size.

Early stages. Only one species has been described in its early stages. The accounts are incomplete. Piepers (1918 : 105, pl. 27, figs 168c) in the Philippines and Morrell (1956 : 105, pl. 18, fig. 1) in Singapore each reared *D. ravindra* from wild larvae, which appear to have about six triangular dorsal projections on the median segments, and to be green and purplish brown, turning to grey dorsally and pink laterally when mature. Foodplants were *Eugenia densiflora* (Myrtaceae) in the Philippines and *Derris scandens* (Leguminosae) in Singapore. Corbet (1956 : 351) gives *Albizzia falcata* (Leguminosae) for the same species. The pupa is brown, attached anally (Morrell), shoe-shaped and [surely in error] 'fastened by a girdle-thread' (Piepers, copied by Seitz).

## Key to the Species of *Drupadia*

(All figure references are to Pls 2–4 for specimens, Pls 5 and 6 for genitalia.)

The underside and the male upperside vary. Except in *D. achaja* the female upperside is constantly dark brown with a subtornal white or bluish white area on the hind wing (figs 41, 48, 88), but the fore wing may bear an ovate orange discal patch. Superficial characters are keyed first, followed where applicable by differences in male genitalia. Fore wing vein 8 is always absent.

1 Fore wing normally lacking vein 9 . . . . . . . . . . 2
– Fore wing vein 9 present, short . . . . . . . . . . 7
2 Underside pale purple-grey with an indistinct reticulate pattern recalling certain *Arhopala* (fig. 44).
Male genitalia large, aedeagus sinuate and valvae evenly tapered to the abrupt apex and long spicule (fig. 99). (Thailand and S. Vietnam only)
**D. achaja** (Fruhstorfer) (p. 294)
– Fore wing underside ochreous; hind wing underside mainly white marked with dark brown and black (figs 52, 53, 83), or ochreous marked with black and white (figs 51, 58, 92) . . . . . . . . . . . . . . . 3
3 Hind wing underside white, chequered to base; immediately separable from others so marked (see 9 below) as the postdiscal spot in space 6 is shifted inwards level with that in space 7 (figs 52, 65). Unci curve ventrad (figs 100, 101) (*Drupadia* proper) . . . . . . . . . . . . . . . 4

– Hind wing underside broadly ochreous at base (figs 45, 58). Unci straight or upcurved as usual . . . . . . . . . . . . 5

4 Much larger, but genitalia smaller; fore wing 18–21 mm. Male with brands and lobed wings (except dwarfs). Sexually dimorphic. Hind wing underside seldom with a reddish line in space 1 internal to the submarginal markings and continued into space 2 (figs 49, 52). Valvae small, basally tapered (fig. 100) ***D. ravindra*** (Horsfield) (p. 295)

– Half the size, but genitalia larger; fore wing 10–12 mm. Male without insignia. Sexes alike. Hind wing underside usually with the innermost subtornal line across spaces 1 and 2 deep orange-red or concolorous with the fore wing (figs 61–68) Valvae basally elliptic, the style from the dorso-caudal edge (fig. 101) ***D. rufotaenia*** (Fruhstorfer) (p. 314)

5 Hind wing underside brown, with narrow white lines separating the darker discal line and the black zig-zag postdiscal and submarginal markings (fig. 58) . . 6

– Hind wing underside base broadly, and apex narrowly, ochreous brown; remainder white with irregular dark spotting (fig. 45) . . . ***D. araotina*** (Evans) (p. 321)

6 Larger; fore wing 12–14 mm. Male upperside black with the tornal half of the hind wing shining bright blue; female similar but dark brown and whitish. Male with the wings strongly lobed, a long black fringe under the fore wing dorsum, and a hind wing brand . . . . . . . ***D. cinderella*** sp. n. (p. 319)

– Smaller; fore wing 10–11 mm. Male upperside entirely dark brown, obscurely shot with purple except at the margins; female as last but the tornal third of the hind wing dull bluish grey. Male without insignia. . . . ***D. cindi*** sp. n. (p. 320)

7 Hind wing underside chequered or spotted . . . . . . . . 8

– Hind wing underside with the basal half unmarked; white with postdiscal and terminal black stripes (figs 96–98) . . . . . . . . 12

8 Hind wing underside with the basal half unspotted, being white with a sharply defined area concolorous with the dark ochreous fore wing, lying above a line from the base of vein 1 to mid costa; the outer half white with prominent irregular black and dark brown spotting (fig. 51) . . . ***D. abnormis*** (Moulton) (p. 321)

– Hind wing underside with the usual chequered markings to the base; the postdiscal quadrate spots in spaces 7, 6 and 5 are in echelon (figs 53, 60, 73) (*Biduanda* proper) . . . . . . . . . . . . . . 9

9 Underside markings on both wings clear, even and regular. Male genitalia relatively compact; valvae with the costal arm oblique, and with a distinct shoulder on the ventral edge before the base of the style; aedeagus short and blunt . . 10

– Underside markings irregular and uneven. Male genitalia longer, overall length twice the depth; valvae with the costal arm as usual, in line with the dorsal edge, and not with a shoulder below the style; aedeagus long and apically tapered . 11

10 Larger; fore wing 16–20 mm (to 23 mm in Sulawesi). Sexually dimorphic; male upperside deep purple-brown with a terminal black line and usually at least the bases of veins 2 to 4 coloured red on the fore wing (fig. 50). Male genitalia very short, the length scarcely exceeding the depth (fig. 104) ***D. theda*** (C. & R. Felder) (p. 322)

– Smaller; fore wing 11–15 mm (to 17 mm in Philippines). Sexes alike or nearly so; upperside dark brown, often with a purple wash and occasionally with orange discal patches on the fore wings (figs 69–72). Male genitalia longer, overall length about 1·5 times the depth (fig. 105) . . . ***D. niasica*** (Röber) (p. 333)

11 Larger; fore wing 13–18 mm. Underside with the markings browner; the apical half of the fore wing costa is darkened, and the cell end bar and the postdiscal band both emanate from the dark area (fig. 60). Male upperside as *theda* but with narrow dark brown terminal borders (fig. 57) . . ***D. estella*** (Hewitson) (p. 339)

Smaller; fore wing 11–15 mm. Underside fore wing costa white to beyond the cell, with the cell-end line (faint in Burma) or bar standing well clear of the postdiscal band (figs 77–84). Male upperside black, with the tornal two-thirds of the hind wing bright shining blue and the costa often orange; the fore wing may be plain (Burma–Thailand, fig. 78) or bear a discal patch which is white (Sikkim, fig. 77) or shining blue (Malaysia southwards, fig. 79) . **D. scaeva** (Hewitson) (p. 341)

12 Smaller; fore wing not over 17 mm. Upperside male shining blue with black borders (fig. 85; but tending in dwarfs to plain dark brown, figs 86, 87), with a white subtornal spot in space 1; female, as in the remaining three species, dark brown with a white subtornal band across spaces 1 to 3 or 4 but, unlike them, with the veins crossing it black (figs. 88). Male genitalia long and delicate, the valvae smoothly tapered to the base of the style (fig. 108) **D. cineas** (Grose-Smith) (p. 345)

– Larger; fore wing over 17 mm. Upperside male purple or dark brown; female with the white subtornal band unmarked. Male genitalia robust, the valvae basally ovate . . . . . . . . . . . . . . 13

13 Male upperside bluish purple. Hind wing underside with the subtornal line across space 1 between the white postdiscal band and the blue metallic scales plain black. Male genitalia small, resembling those of *ravindra* (fig. 111) **D. cinesia** (Hewitson) (p. 348)

– Male upperside pinkish purple or dark brown. Hind wing underside space 1 with the first subtornal stripe beyond the white postdiscal band red. Male genitalia large as usual . . . . . . . . . . . . 14

14 Larger; fore wing 18–20 mm. Sexually dimorphic, the male upperside purple. Fore wing underside, as last, bright ochreous-orange. Male fore wing upperside with an oval brand (as in *Ritra*) about the cell end (fig. 93). Base of tegumen and base of valva subequal (fig. 109) . . . **D. cinesoides** (Nicéville) (p. 347)

Smaller; fore wing 17–18 mm. Sexes alike, as female of last two (fig. 94, ♂). Fore wing underside distinctly paler than last two, only bright ochreous along the extreme termen. Male without insignia. Tegumen attenuate, its base narrower than the base of the valva (fig. 110) . . **D. johorensis** (Cowan) (p. 348)

## Discussion of the species and subspecies

### *Drupadia achaja* (Fruhstorfer)

(Text-fig. 5; Pl. 2, figs 40, 44; Pl. 5, fig. 99)

*Horaga achaja* Fruhstorfer, 1912 : 233. Holotype ♂, THAILAND (see text).
*Horaga achaja* Fruhstorfer; Riley & Godfrey, 1925 : 141, pl. 3, fig. 1.
*Horaga achaja* Fruhstorfer; Seitz, 1926 : 982, pl. 158, fig. a9.

Fore wing veins 8 and 9 are absent. The hind wing tornus is as usual produced up to vein 3, with short tails at veins 1, 2 and, in the female only, 3, being rounded at the end of vein 3 in the male. Differs from *Horaga* Moore in the longer fore wing cell, which here exceeds half the fore wing costa and the length of vein 12.

Male with sooty black brands, on the fore wing underside about most of the basal half of vein 1, and on the hind wing upperside about the basal half of vein 7.

Male genitalia large, abnormal. Unlike *Horaga* the vinculum is short and narrow, set more vertically than obliquely in the abdomen, with the tegumen and uncus, and the valvae, consequently nearly perpendicular to it instead of acutely inclined. Tegumen triangular, broad-based, long and isosceles; the unci dilate before the thin upcurved apical blades. Valva substantial, long, evenly tapered to the abrupt downturned spicule; costal arm short, inclined towards the dorsum. Aedeagus very stout, sinuate, with depressed apex.

Upperside of male dark brown, with a dark purple suffusion in the discal areas which is extensive on the fore wing, restricted on the hind wing; and a small ovate white patch about the fore wing cell end. Female larger, paler overall, and with the white patch larger.

Underside of both sexes dull greyish brown, the male obscurely washed with lilac; with finely etched black, white-edged lines in pairs, forming catenulate transverse bands; median, postdiscal and marginal, and at the hind wing cell end; the fore wing cell end marked with a small white patch.

Fore wing length: ♂ 12–13 mm, ♀ 15–16 mm.

An isolated little species, geographically and anatomically, which will probably merit a separate genus. Fruhstorfer's single male was from Hin Lap, a small railway halt (next to his Muok Lek locality), 120 km north-east of Bangkok. Godfrey independently discovered both sexes in the Me Song forest 40 km north of Phrae in north Thailand, and extended the range within five years to Da Lat in South Vietnam. The only other recorded locality, Chaiyaphum, is 230 km north-east of Bangkok, central to the first three, and all are at an altitude of about 300 metres.

Fruhstorfer must have dissected the holotype, for it was the accidental discovery of his preparation (Fruh. 4148) in the BMNH which led to the investigation of the Horagini and the transfer of this species to *Drupadia*. The whereabouts of the holotype itself, which Seitz presumably used for his illustration, is not known. It was probably damaged, as Seitz shows it with an extra tail at vein 3, as usual in these genera.

MATERIAL EXAMINED.

*Horaga achaja* Fruhstorfer, holotype ♂, genitalia preparation only (Fruh. 4148), no data [THAILAND: Hin Lap, 14°40′N., 101°5′E., 300 m, i. 1900 (*Fruhstorfer*)].

THAILAND: 4 ♂, 2 ♀ (including ♀ 'allotype' designated by Riley & Godfrey, 1925), Me Song, iv. 1916 (*Godfrey*); 1 ♂, Chaiyaphum, i. 1931. SOUTH VIETNAM: 1 ♀, Da Lat [no date, presented 1921] (*Godfrey*).

All in BMNH.

### ***Drupadia ravindra*** (Horsfield) **comb. rev.**

(Text-figs 1, 2; Pl. 1, figs 16–39; Pl. 2, figs 42, 46, 49, 52; Pl. 5, fig. 100)

*Thecla ravindra* Horsfield, 1828 : pl. 1, figs 11, 11a, explic. p. 1.

Upperside of male fore wing velvet-black, hind wing blue; female dark brown, with a narrow pale blue-grey subtornal suffusion on the hind wing.

Underside of fore wing basally white, outwardly orange, brownish grey, or grey, with a dark basal streak, bars mid-cell and at cell-end, postdiscal band and submarginal line; hind wing apex washed with the fore wing colour and with the usual black tornal spots and metallic blue scaling, the remainder, from base to termen, pure white with prominent square black chequered markings.

That basic pattern varies subspecifically as follows (Pl. 1).

The upperside of the fore wing may have a discal orange patch, which may cover most of the wing or may show only as a rosy flush; sometimes the base may be blue (male) or grey (female). The hind wing may vary in tint (male), or in the extent and shade of the pale subtornal area (female).

On the underside the fore wing ground colour may be the same in both sexes or it may differ;

the hind wing markings sometimes become brown or orange, and may be reduced to parallel pairs of short lines instead of solid squares.

The best known species of the genus, this is probably also the most interesting. It would certainly repay research. The interrelationship of its extraordinarily diverse subspecies, the regular occurrence of dwarf individuals, and the significance of the separate sibling species *rufotaenia*, are its most intriguing aspects. Material is needed from the many unworked areas. Only cursory attempts at breeding it have as yet been made.

The first two subspecies discussed are very lightly marked on the hind wing underside, and there is more orange than black on the upperside of the fore wing. In the 100-mile stretch of the Kra Isthmus, between 10° and $8\frac{1}{2}$°N., a quite spectacular change occurs from the Burmese *boisduvalii* just described to the Malayan *moorei*, which has a boldly marked underside and the fore wing above plain black. No one has yet explored this small area.

The diversity of the seven subspecies in the oceanic zone of Sumatra has already been noted (Text-fig. 1), in striking contrast to the uniformity east of the watershed, where the same *moorei* ranges the length of the island as well as throughout the Malay peninsula and Borneo-Kalimantan. Here it appears to cover the northern and western lowlands, to the Sabah border at least, territory which also seems to be occupied by *lisiades*. For lack of information I continue to treat this as a good subspecies. It has a small orange patch and might be submontane, or possibly an inland intermediate towards the vividly orange *fulminans* of the south and east Kalimantan coasts, reaching east Sabah; but the unique blue shade of its male hind wing should be noted.

Sabah appears to comprise a remarkable *clinocentre*, where at least two other subspecies fly together, Dr T. Norman having confirmed earlier records by taking series of *surindra* (perhaps submontane) and *joloana* near Tawau in the same month of 1961. Individuals of *ravindrina* have also been taken, by more than one collector, in east Sabah. This does not prove the existence of different species; *ravindra* is ecologically sensitive, and the reasons for this seeming polymorphism must be sought. Local geological faults, microclimates in this exposed corner of the island, the attentions of 'different kinds of ants' in the early stages, and temporary re-invasions from the Sulu Archipelago (by *joloana*) and from Palawan (by *ravindrina*) may be suggested.

To the south and east, in the Philippines, the chequered markings on the underside are reduced again; not to the faint outline pattern of the north-western races, but to small black dots. A new subspecies is proposed for Mindoro where this reaches an extreme.

This is the only species yet known from Java and Bali, where there is some evidence of slight seasonal variation. Such variation is found otherwise only in Burma, where again it is slight compared with that of many other Rhopalocera. This seasonal stability of *ravindra*, compared with its geographical polymorphism, suggests some inherent reason for it not having penetrated north of Burma. Altitude also affects it slightly, chiefly causing greater size and brighter colour, but these effects are of varietal rather than of subspecific order. Another trait, found in *moorei*, is that specimens from small islands like the Langkawi, Tioman and the Natunas, tend to have a greenish tint to the blue hind wing of the male, while the female hind wing tornal area is a bluish grey. The point is noted as needing investigation of its cause rather than the creation of further subspecies.

Dwarfs of *ravindra* (Pl. 2, figs 42, 46) can easily be mistaken for normal *rufotaenia* (figs 43, 47), whose 'red ribbon' is not an infallible guide, since that subtornal band is often pale rufous in the former and may be dark in heavily marked specimens. Male dwarf *ravindra* can best be diagnosed by the presence of at least some residual shining blue scales on the hind wing upperside, but females can be very difficult. Intermediate-sized specimens seem equally rare in collections, but perhaps some are involuntarily discarded as undersized. Dissection of males leaves no doubt; their genitalia are normal *ravindra*, much smaller than, as well as differently shaped from, *rufotaenia* (Pl. 5, figs 100, 101). Corbet (1956 : pl. 16, fig. 242) used a dissection (ASC 253) of an extreme dwarf of mine from Singapore without comment to illustrate *ravindra*, placing immediately below it (fig. 247; ASC 252) his preparation from my Singapore *rufotaenia*, but those figures are not to scale and so the size difference is lost. Presumably, if the dwarf male can overcome the handicap of lack of insignia, his courtship of a normal-sized female will be successful. Presumably also, a dwarf male *ravindra* could not measure up to the requirements of a similar-sized female *rufotaenia*.

Rearing of *D. ravindra moorei* in Singapore was carried out with wild larvae by Morrell (1956, repeated 1957), but he recorded few details. One specimen 'bred' by him is in the BMNH and is a heavily marked extreme dwarf female, indistinguishable from *rufotaenia*. To my enquiry, he replied (*in litt.*, 1967) that he had reared only three or four specimens from larvae found at different times on the same foodplant, and had noticed nothing abnormal. In his paper he noted that the larvae were constantly attended by ants in the wild, but they were 'not essential apparently to their well-being, as I have taken half-grown larvae and [reared] them into normal-sized imagines'. It seems possible, nevertheless, that deprivation of ants may cause dwarfing.

Careful distinction is needed between rearing, from collected ova, larvae or pupae, and breeding, which should imply mating between known parents followed by rearing *ab ovo* to maturity. The latter is, clearly, the more valuable.

## Key to Subspecies of *D. ravindra*

(Pl. 1, figs 16–39; Pl. 2, figs 49, 52)

1 Fore wing underside ground colour orange in both sexes . . . . . . 2
– Fore wing underside ground colour other than orange in one or both sexes . . 10
2 Fore wing upperside with an orange discal patch . . . . . . . 3
– Fore wing upperside normally without an orange patch . . . . . . 8
3 Hind wing underside with the dark discal and postdiscal quadrate spots obsolescent; only the inner and outer edges marked, by pairs of brownish lines. (Burma to Vietnam) (fig. 30) . . . . . . . . . . . . . . 4
– Hind wing underside with chequered black markings on white . . . . . 5
4 Hind wing underside with the outline markings nearly black. The orange area on

the fore wing upperside is restricted to an oblique band across the central third of the wing, from near mid-costa to near tornus. The blue hind wing upperside of the male has a distinct pale greenish tint in the distal half **rav. corbeti** nom. n. (p. 299)

– Hind wing underside markings paler, orange-brown. The orange area on the fore wing upperside is most extensive, usually leaving only the narrow dark borders and apex, and sometimes recurring on the hind wing disc. The male hind wing upperside is black above vein 7, and below it shades from dark blue to light blue at the tornus, with an overall reflection which is deep violet when viewed from the rear, but pale grey when viewed from in front (figs 18, 30) **rav. boisduvalii** Moore (p. 300)

5 Fore wing underside clear orange. Male hind wing upperside deep blue or purple, with the costa black above vein 6 . . . . . . . . . 6

– Fore wing underside in the male lightly suffused grey in the disc; the basal third white and the dorsal space white below a broad blackish streak along vein 1. Male hind wing upperside bright blue, with the costa mainly white. (West coast, north Sumatra) (figs 17, 29) . . . . . . . **rav. esla** (Swinhoe) (p. 303)

6 Fore wing upperside with the orange patch ovate and oblique, diffuse, and the veins across it marked black. (Banka Is., S.E. of Sumatra) . **rav. banka** (Riley) (p. 309)

– Fore wing upperside with the orange patch quadrate, the longer axis parallel to the dorsum, and clearly defined. (Borneo, Kalimantan) . . . . . . 7

7 Fore wing upperside with the orange patch small, about one quarter of the wing area, and outwardly diffuse. Male hind wing upperside dark blue without strong reflections. . . . . . . . **rav. lisiades** (Fruhstorfer) (p. 310)

Fore wing upperside with the orange patch large, two thirds of the wing area, clear and unsullied. Male hind wing upperside rich deep purple-blue, strongly shot with deep violet (figs 19, 31). . . . . **rav. fulminans** (Staudinger) (p. 311)

8 Male hind wing upperside shining blue with an obscure violet reflection when viewed from above or to the rear, but dull grey seen from in front; the costa black in space 6 to white in space 8. Female hind wing upperside, as in all species hitherto, with the subtornal quarter pale bluish grey. (Malay peninsula, E. Sumatra, W. & N. Borneo and Kalimantan) (figs 22, 34) . **rav. moorei** (Distant) (p. 302)

– Male hind wing upperside uniform shining purple-blue at all viewing angles, and costa above vein 7 grey. Female upperside very dark brown, with a narrow blue subtornal line. (Palawan to Philippines) . . . . . . . 9

9 Fore wing underside only slightly paler orange than normal. Hind wing underside with the black markings normal or only slightly reduced **rav. ravindrina** (Staudinger) (p. 313)

– Fore wing underside pale creamy orange. Hind wing underside with the black markings much reduced (Mindoro) (figs 49, 52) . **rav. resoluta** subsp. n. (p. 313)

10 Fore wing underside ochreous grey in the male; pale ochreous in the female. Hind wing upperside uniform blue with a dark margin in the male; dark brown in the female with the tornal third very pale greyish white. (Sabah, ? submontane) (figs 23, 35) . . . . . **rav. surindra** (Druce) (p. 311)

– Fore wing underside either whitish or strongly coloured . . . . . . 11

11 Fore wing underside white with the termen pale ochreous. Smaller than usual (Jolo Is.) (figs 27, 39) . . **rav. joloana** (Staudinger) (p. 312)

– Fore wing underside coloured . . . . . . . . . . . . . 12

12 Fore wing underside deep orange, heavily suffused dark grey in the male; orange in the female. (West coast of south Sumatra, and the oceanic island chain) . . 13

– Fore wing underside dark grey or chololate-grey. (Java to Lombok) . . . 18

13 Fore wing upperside with the base dark as usual . . . . . . . 14

– Fore wing upperside with the base blue in the male, and (except *janus, sumptuosa*) overlaid with pale grey in the female . . . . . . . . 16

14 Male hind wing upperside with the costa above vein 6 mainly solid black (Telo) (figs 20, 32) . . . . . . . . ***rav. batuna*** (Riley) (p. 305)
– Male hind wing upperside with the costa mainly white . . . . . . 15
15 Male hind wing upperside with the basal third suffused with black (Simeulue) ***rav. serunica*** (van Eecke) (p. 304)
– Male hind wing upperside bright blue to the base (Mentawei Is.) (figs 24, 36) ***rav. connexa*** (Riley) (p. 305)
16 Fore wing upperside with a large orange patch (Nias) (figs 16, 28) ***rav. caesarea*** Weymer (p. 304)
– Fore wing upperside without a prominent orange patch; at most a dull diffuse one (S.W. Sumatra) . . . . . . . . . . . . . . 17
17 Male upperside shining blue, the fore wing with narrow costal and terminal borders and the apical third black. Female upperside dark brown, the fore wing with at most a trace of an orange discal spot, the hind wing with the tornal half greyish blue (figs. 21, 23). . . . . . ***rav. sumptuosa*** (Toxopeus) (p. 306)
– Male fore wing upperside black, with a small round subbasal blue area and beyond it a smaller ovate reddish discal patch which is suffused with black and often obsolete. Female as last, but the subtornal pale area is smaller and less blue (figs 25, 37) . . . . . . . . ***rav. janus*** (Riley) (p. 306)
18 Seasonally variable in size and appearance. Fore wing length 16–20 mm. Male hind wing upperside with the blue area extensive in large specimens; in smaller ones it at least fills most of spaces 5 and 6, and reaches the termen in space 3. Female fore wing underside perceptibly browner than that of the male (figs 26, 38) . . . . . . . . ***rav. ravindra*** (Horsfield) (p. 307)
– More constant. Fore wing 15–17 mm. On the male hind wing upperside the costal and apical black area fills most of spaces 5 and 6 and, sharply tapering, forms a narrowing border round the termen and tornus. Female fore wing underside darker, the sexes almost identical in colour . . ***rav. balina*** (Fruhstorfer) (p. 309)

## ***Drupadia ravindra corbeti*** **nom. n.**

*Papilio lisias* Fabricius, 1787 : 65, no. 615. 1 ♂, 1 ♀ syntypes, SOUTH VIETNAM (BMNH) [seen]. [Primary homonym of *Papilio lisias* Cramer, 1777.]
*Hesperia lisias* (Fabricius); Fabricius, 1793 : 261, no. 12.
*Papilio lisias* Fabricius; Donovan, 1801 : [44], pl.[40], fig. 1, ♂.
*Papilio lisias* Fabricius; Westwood, 1842 : 60, pl. 44, fig. 1, ♀.
*Drupadia lisias* (Fabricius); Waterhouse, 1886 [Feb.] : pl. 165, figs 2, ♂, 3, 3a, ♀.
*Biduanda lisias* (Fabricius); Moore, 1886, [Nov.] : 42 n.
*Marmessus* (*Drupadia*) *lisias* (Fabricius); Nicéville, 1890*a* : 429 n., 430.
*Papilio lisias* Fabricius; Corbet, 1941 : 101.

*Papilio lisias* Cramer is a South American Riodinid. Corbet pointed out the homonymy of the Fabrician name but did not replace it. To commemorate his careful researches into the Linnean and Fabrician names I here propose the replacement name *Drupadia ravindra corbeti* nom. n.

The appearance is described in the key. The two original, and only known specimens, in the Banks collection, BMNH, are in very brittle condition. I have seen them under glass, but would not handle them.

As several early authors noted, Donovan's figures were not up to his usual standard, but Waterhouse provided excellent ones. He also correctly identified the type-locality.

In the original description Fabricius gave the date 'Pulicandor, Mus. dom. Banks', varied in his next work to 'Poulicandor, Mus. dom. Banks'. For a long time the name was used to cover Burmese specimens (see the next subspecies), until in 1886 both Waterhouse and Moore noticed the differences. Moore located *lisias* in 'Pulo Kondul, in the Nicobar Islands', and Waterhouse was overlooked. Nicéville followed Moore. Fruhstorfer (1912 : 248) rediscovered Condor, but Seitz (1926 : 989) was confused. Finally Corbet put the matter beyond doubt.

Pulo (poulo, pulau, etc.) means Island, and although now little known, P. Condor (8°41'N., 106°36'E.) in former times was on most maps. It was an established landfall (visited by Marco Polo) on the Europe – China voyage via Cape of Good Hope – Sunda Strait – Canton. Linnaeus's senior pupil, Christopher Tärnström died there in 1846 on his way from India to China. Relevant to *Papilio lisias*, the *Resolution* and the *Discovery* anchored there from 21 to 28 January, 1780 for wood, water, and meat on the hoof, ready for the long passage home. The collectors went ashore there several times. No other landings were made in the region until, having passed P. Tioman and negotiated the Bangka Strait, they anchored off Krakatoa [Rakata] and Prinsep [Panaitan] islands before crossing the Indian Ocean. In 1967, while stationed at Saigon, Major A. Bedford Russell visited P. Condor to seek fresh specimens, but saw none. The jungle there is now much reduced. An old name for P. Condor recently reintroduced is Con Son.

As noted under *D. r. boisduvalii* below, specimens of that subspecies from continental South Vietnam approach the appearance of *corbeti*, but they do not attain the differences given in the key.

MATERIAL EXAMINED.

*Papilio lisias* Fabricius, 1 ♂, 1 ♀ syntypes, SOUTH VIETNAM: Pulo Condor [i. 1780] (BMNH).

### ***Drupadia ravindra boisduvalii*** Moore **comb. rev.**

(Pl. 1, figs 18, 30)

[*Myrina lisias* (Fabricius); Godart, 1824 : 593, no. 2.]
[*Myrina lisias* (Fabricius); Boisduval, 1836 : pl. 22, fig. 2, explic. p. 6.]
[*Myrina lisias* (Fabricius); Doubleday, 1847 : 21.]
[*Myrina lisias* (Fabricius); Butler, 1870 : 184.]
[*Hypolycaena lisias* (Fabricius); Moore, 1879 : 833.]
*Drupadia boisduvalii* Moore, 1884 : 31. LECTOTYPE ♂, BURMA (BMHN), here designated [examined.]
*Biduanda boisduvalii* (Moore); Moore, 1886 : 42.
*Drupadia boisduvalii* Moore; Nicéville, 1890*a* : 430, pl. 29, fig. 230 (adding at : 429 n., 'should be *Marmessus* Hübner').
[*Marmessus lisias* (Fabricius) syn. *boisduvalii* (Moore); Swinhoe, [13 Feb.] 1912 : 191, pl. 740, figs 1, 1a, 1b. Misidentification.]
*Marmessus lisias boisduvali* (Moore); Fruhstorfer, [Apr.] 1912 : 248.
*Marmessus lisias boisduvali* (Moore) f. *alcira* Fruhstorfer, 1912 : 248. Type-material, BURMA (not located).

*Marmessus boisduvali* (Moore); Seitz, 1926 : 989, pl. 159, fig. c4.
*Marmessus boisduvali* (Moore) f. *alcira* Fruhstorfer; Seitz, 1926 : 989, pl. 159, fig. d5. [Misidentification of f. *alcira*.]
*Marmessus ravindra boisduvali* (Moore); Corbet, 1948 : 102.

Godart located his specimen from 'la presqu'île en deçà du Gange', perhaps the same as Boisduval's 'Bengale'. Boisduval's actual specimen appears to be in the BMNH, labelled '*lisides* Boisd., Sylhet' in ms. on stiff card; '*lisias* Fab.' in ms.; '*Myrina lisias* Bdv., *Species G'al.*, pl. 22, fig. 2' in ms.; and 'Ex Musaeo Dris. Boisduval' on a printed label, ex coll. Oberthür. Butler gave the locality 'Barrackpur', which is in India, West Bengal, and close to the former specimen from the border of Indian Assam and Bangladesh. This may represent an earlier distribution but was more likely the base from which the collectors operated. Certainly Nicéville was positive that the northern limit of the species was the 'Chittagong Hill Tracts', on the border between Bangladesh and Burma.

Moore was the first to detect differences between *lisias* [*corbeti*] and the continental form, and he cited Boisduval's figure in describing both sexes of *boisduvalii*, adding 'Moulmein; Mergui; in colls. Moore and Mus. Calcutta'. In the BMNH Type Collection are a male and a female, both ex coll. Moore, labelled as '♂ Type' and '♀ Type' of *boisduvalii* Moore. Of these syntypes I now designate the male as lectotype of *boisduvalii* Moore.

There is little seasonal variation in this subspecies, the only one in which appreciable changes might be expected. Some dry season specimens have small orange discal spots or bars across spaces 4 and 5 on the hind wing upperside, the orange of the fore wing paler and more extensive, and the underside markings faint. Moore's female syntype is like this. The figure called *alcira* by Seitz is simply a rather small and dark female, and does not represent Fruhstorfer's dry season form, of which no type-material has been located.

The upperside and underside markings gradually become slightly darker through Thailand to South Vietnam, approaching but not attaining the appearance of *corbeti*. A specimen ex coll. Fruhstorfer is labelled 'Tay Ninh, Cochin China' [South Vietnam, 90 km north-west of Saigon], and '*lisias euthydemus* Fruh. Type'. It is a normal male for the area, and the name probably remains unpublished because Fruhstorfer considered the specimen transitional. The north-eastern limit of the range of the species in continental Asia is uncertain.

MATERIAL EXAMINED.

*Drupadia boisduvalii* Moore, lectotype ♂ [BURMA]: Moulmein.

Paralectotypes. 1 ♀ [BURMA]: Moulmein; 1 ♂ [? BANGLADESH]: 'Sylhet' (ex coll. Boisduval).

BURMA: 9 ♂, 10 ♀, Karen Hills; 36 ♂, 17 ♀, Toungoo-Rangoon; 250 ♂, 143 ♀, Moulmein – Mergui. THAILAND: continental, 17 ♂, 11 ♀; peninsular, down to 10°N., 6 ♂, 13 ♀. LAOS-SOUTH VIETNAM: 4 ♂, 3 ♀.

Note. 1 ♀, 'Chusan, Mongolia'. Perhaps mislabelled from Mergui, *c.* 1842 (*T. E. Cantor*). Cantor served in Penang as a surgeon for the East India Company after he returned from the 1840–1841 expedition to Chusan Islands, near Shanghai (not Mongolia).

### ***Drupadia ravindra moorei*** (Distant) **comb. rev.**

(Text-fig. 1; Pl. 1, figs 22, 34; Pl. 2, figs 42, 46)

*Sithon moorei* Distant, 1882*a* : 246. Type-material, WEST MALAYSIA: Province Wellesley (not located).
*Drupadia moorei* (Distant); Distant, 1884 : 236, fig. 68, pl. 20, figs 20, 21, [? 30].
*Biduanda similis* Druce, 1895 : 616. Holotype ♂ BORNEO (BMNH) [examined]. **Syn.n.**
*Marmessus moorei* (Distant); Nicéville & Martin, 1896 : 481, no. 487.
*Marmessus moorei sumatranus* Fruhstorfer, 1912 : 272. Type-material, INDONESIA: N.E. Sumatra (not located). **Syn. n.**
*Marmessus moorei sumatranus* Fruhstorfer f. *battakana* Fruhstorfer, 1912 : 272. Holotype ♀, INDONESIA: N.E. Sumatra (BMNH) [examined]. **Syn. n.**
*Marmessus moorei nola* Fruhstorfer, 1912 : 250. Holotype ♂, BRUNEI (BMNH) [examined]. **Syn. n.**
*Marmessus lisias moorei* (Distant); van Eecke, 1914 : 256.
*Marmessus moorei* (Distant); Seitz, 1926 : 989.
*Marmessus similis* (Druce); Seitz, 1926 : 990.
*Marmessus sumatranus* Fruhstorfer; Seitz, 1926 : 989, pl. 159, figs f7, f8 [nec f5, f6 = *thesmia*].
*Marmessus battakana* Fruhstorfer; Seitz, 1926 : 990.
*Marmessus nola* Fruhstorfer; Seitz, 1926 : 990.
*Drupadia* (*Marmessus*) *ravindra mola* [sic] (Fruhstorfer); Barlow, Banks & Holloway, 1971 : 293.

Described in the key and figured on Pl. 1. Distant's type-material has not been located. His figures all show vein 9 present on the fore wing. Druce's specimen was described as a *Biduanda* because it definitely has vein 9, an abnormality which would not debar *similis* Druce from priority over the name *nola* Fruhstorfer in Borneo, should synonymy with *moorei* Distant not be admitted. No type-material of *Marmessus sumatranus* Fruhstorfer has been found.

In the north of Sumatra and of West Malaysia, and particularly in Penang [Pulo Pinang], the fore wing upperside often has definite traces of an orange patch in the disc, but no constant distinction can be found between the general populations of eastern Sumatra and the adjacent mainland. For such specimens from Penang and from the Battack mountains west of Medan the name f. *battakana* Fruhstorfer may be retained. They are in fact respectively intermediates to the subspecies in Burma and *D. rav. esla* Swinhoe of western Sumatra.

There is an interesting tendency on smaller islands for the male hind wing upperside to develop a greenish tint. Examples have been seen from Langkawi, Tioman and Natuna islands, and it is evident in Condor.

The only other notable variation is that of dwarfing. An extreme dwarf male from Singapore is figured (Pl. 2, figs 42, 46) alongside a male *D. rufotaenia* from the same place for comparison, although the latter is very heavily marked below. The residual shining blue area on the hind wing upperside of the former distinguishes it.

MATERIAL EXAMINED.

*Biduanda similis* Druce, holotype ♂, 'Borneo' [?EAST MALAYSIA; Sabah] (ex coll.

Rev. R. P. Murray in original description). *Marmessus moorei sumatranus*, f. *battakana* Fruhstorfer, holotype ♀, INDONESIA: N.E. Sumatra, Battack Mountains (*L. Martin*). *Marmessus moorei nola* Fruhstorfer, holotype ♂, BRUNEI, 1890 (*Waterstradt*).

THAILAND: Nakhon Si Thammarat [8½°N.] and southwards, 3 ♂. WEST MALAYSIA: Langkawi Is, 4 ♂, 2 ♀; Penang, 9 ♂, 23 ♀; Perak to SINGAPORE: 62 ♂, 71 ♀; Tioman, 2 ♂, 2 ♀ (in coll. G. C. Stubbs). INDONESIA: N.E. Sumatra; Medan to Battack Mts, 37 ♂, 38 ♀: Palembang, 2 ♂, 2 ♀; Lingga Is, 2 ♀; Natuna Is, 3 ♂, 3 ♀; Kalimantan, Pontianak, 1 ♀, Sintang, 1 ♀, Pulo Laut, 1 ♂. EAST MALAYSIA: Sarawak to Sabah, 27 ♂, 15 ♀.

Note. 1 ♂, 1 ♀, 'Minahassa, Celebes' (ex coll. Staudinger); 1 ♂, 'Macassar, Celebes (*Halliburton*)'; and 1 ♂, 'Jolo' (ex coll. Fruhstorfer), are probably faulty labels.

### ***Drupadia ravindra esla*** (Swinhoe) **comb. n.**

(Text-fig. 1; Pl. 1, figs 17, 29)

[*Marmessus boisduvalii* (Moore); Nicéville & Martin, 1896 : 481, no. 488.]
*Biduanda esla* Swinhoe, [13 Feb.] 1912 : 190. Holotype ♂ INDONESIA: Sumatra (BMNH) [examined; fore wing vein 9 absent].
*Marmessus lisias iskander* Fruhstorfer, [April] 1912 : 249. Type-material, INDONESIA: West & N.E. Sumatra (not located). [Synonymized with '*cala* Swinhoe' by Riley, 1944 : 266.] **Syn. n.**
*Marmessus iskander* Fruhstorfer; Seitz, 1926 : 989, pl. 159, figs c7, c8.
[*Marmessus comla* (Fruhstorfer ms.) Seitz, 1926 : 989, 1014, pl. 159, figs c5, c6. Misidentification.]

Seitz ignored both *esla* Swinhoe and *comla* Swinhoe (for the latter see below under *caesarea* Weymer), and his figures of *iskander* are excellent for *esla*. His figures of '*comla*', which he listed (p. 1014) as a new Fruhstorfer ms. name, represent transitions towards form *battakana* Fruhstorfer. There are several such specimens in the BMNH ex coll. Martin, who lived and collected on the plains round Medan, sending collectors into the Battack Mountains (Nicéville & Martin, 1896 : 357–361), and who supplied Fruhstorfer. They include all intergrades from normal *moorei* Distant to near *esla* Swinhoe.

Fruhstorfer's *iskander* type-material has not been found.

The range of *esla* as now known is the 450 km stretch of the western slopes of the Barisan mountain range, from just north of Sibolga to just south of Padang, or between 3°N. and 1°S.

MATERIAL EXAMINED.

*Biduanda esla* Swinhoe, holotype ♂, INDONESIA: 'Sumatra' (in original description), (*Sachs*) (ex coll. Swinhoe; Crowley bequest).

INDONESIA: Sumatra, 1 ♂, 1 ♀, 'C.M.B.' [? central Battack Mts.]; 1 ♀, Sibolga; 2 ♀, Sumatra (*Sachs*); 1 ♀, Sumatra; 5 ♀, Padang Sidempoean [1°25'N., 99°15'E.]; 1 ♂, 1 ♀, Batang Proepoe, Padang Bovenlanden (*van der Poll*).

### ***Drupadia ravindra serunica*** (van Eecke) **comb. n.**

(Text-fig. 1)

*Marmessus lisias serunicus* van Eecke, 1914 : 255, fig. 5; pl. 4, fig. 5. Type material, INDONESIA: Simeulue Is. (not located).

Simeulue is the northernmost of the offshore island chain to the west of Sumatra. This subspecies is close to *esla* from the nearby coast of the latter, and entirely distinct from *caesarea*, found on the neighbouring island of Nias.

Van Eecke was the first to examine the genitalia of the species, and to recognise that the forms which, for instance, Fruhstorfer two years earlier had grouped under *lisias*, with the orange patch, *moorei* with no patch but still orange on the fore wing underside of both sexes, and *ravindra* with a dark grey underside, together with several which he could not allot, were really all conspecific. The Simeulue subspecies, with a small patch and a dark underside in the male only, links them, and van Eecke named it to signify the fact (*serunicus*; 'together at last').

No material seen.

### ***Drupadia ravindra caesarea*** Weymer **comb. rev.**

(Text-fig. 1; Pl. 1, figs 16, 28)

[*Sithon ravindra* (Horsfield); Kheil, 1884 : 33, no. 9.]
*Drupadia caesarea* Weymer, 1887 : 9, pl. 2, fig. 4. Type-material, INDONESIA: Nias Is. (not located).
*Sithon ravindra* (Horsfield), var.; Staudinger, 1888 : 277.
*Sithon moorei niasicola* Staudinger, 1889 : 109, 164 [correction for *niasica* (p. 109), nom. praeocc.]. Type-material, INDONESIA: Nias Is. (not located).
*Marmessus comla* Swinhoe, 1912 : 194. Syntype ♂, ♀, INDONESIA: 'Sumatra' (BMNH) [examined].
*Marmessus lisias caesarea* (Weymer); van Eecke, 1914 : 255.
*Marmessus caesarea* (Weymer) = *niasica*, *niasicola* (Staudinger); Seitz, 1926 : 989, pl. 159, figs d2, d3; and d6 as '*niasica*'.
*Marmessus lisias caesarea* (Weymer) = '*corula*' [*comla*] Swinhoe; Riley, 1944 : 265.

After his three years' stay on Nias, Kheil reported this species as rare. Weymer's good description and illustration were overlooked by Staudinger, who described Nias specimens as *niasica* (p. 109) but, realising in time that this name was preoccupied, altered it to *niasicola* in his corrigenda (p. 164) which were published in the same issue of the *Iris*. Thus *niasica* Staudinger was an incorrect original spelling and should not have been used, but it confused Seitz, whose excellent figure of the male *caesarea* is labelled *niasica*. *Sithon niasica* Röber, 1886 is an entirely different species, discussed below after *D. theda*.

This is an extraordinarily differentiated subspecies. Both the male, with its silvery blue hind wing and fore wing base (fig. 16), and the female, are quite distinct. The latter, with the normal dark brown upperside strongly suffused with greyish white on both wings, is like a large version of the male *D. rufotaenia* *caesia* shown at Pl. 3, fig. 61 (which, with two females, was found in the BMNH series of *caesarea* females).

Weymer's type-material has not been located, nor has that of Staudinger.

MATERIAL EXAMINED.

*Marmessus comla* Swinhoe. 1 ♂, 1 ♀, syntypes, INDONESIA: 'Sumatra' (*Sachs*) [both chemically discoloured].

INDONESIA: Nias Island, 33 ♂, 33 ♀; 'Sumatra' (*Sachs*), 2 ♀.

### ***Drupadia ravindra batuna*** (Riley) **comb. n.**

(Text-fig. 1; Pl. 1, figs 20, 32)

*Marmessus lisias batuna* Riley, 1944 : 266. Holotype ♂, INDONESIA: Batu Is., Pulau Telo (BMNH) [examined].

Telo is one of the smaller islands, in the north-west of the Batu group.

The syntype figured on Pl. 1 has the fore wing upperside orange patch larger and less dusky than typical, and the underside, usually as in *connexa* (fig. 36), has the grey suffusion considerably reduced.

MATERIAL EXAMINED.

*Marmessus lisias batuna*, holotype ♂, INDONESIA: Batu Is., Pulau Telo, viii. 1896 (*I. Z. Kannegieter*).

Paratypes. INDONESIA: Pulau Telo, allotype ♀, 1 ♀, viii. 1896 (*I. Z. Kannegieter*); Batu Is., 1 ♂, ix. 1896 (*I. Z. Kannegieter*).

### ***Drupadia ravindra connexa*** (Riley) **comb. n.**

(Text-fig. 1; Pl. 1, figs 24, 36)

*Marmessus lisias connexa* Riley, 1944 : 265, pl. 1, figs 14, 15. Holotype ♂, INDONESIA: Siberut (BMNH) [examined].

In addition to the differences given in the key, the hind wing underside appears to be constantly more heavily marked in black than is the case in *batuna*, to which it is very close.

MATERIAL EXAMINED.

*Marmessus lisias connexa* Riley, holotype ♂, INDONESIA: Siberut, ix. 1924 (*C.B.K. & N.S.*) [Kloss & Smedley].

Paratypes. INDONESIA: ♀ allotype, 3 ♂, 1 ♀, Siberut, ix. 1924 (*C.B.K. & N.S.*) [Kloss & Smedley]; 3 ♀, Sipora, x. 1924 (*C.B.K. & N.S.*); 1 ♂, Sipora, xi. 1924 (*H. H. Karny*).

### ***Drupadia ravindra sumptuosa*** (Toxopeus) **comb. n.**

(Text-fig. 1; Pl. 1, figs 21, 33)

*Myrina ravindra* (Horsfield); Boisduval, 1836 : pl. 22, fig. 1, expl. p. 6.
*Marmessus ravindra sumptuosa* Toxopeus, 1931 : 421, 424. Holotype ♂, INDONESIA: Bengkulu (Rijksmuseum van Natuurlijke Historie, Leiden).
*Marmessus sumptuosa* Toxopeus; Sclater, 1935 : 311.

Toxopeus's paper, in title and text, dealt with Java, and the *Zoological Record* (ed. Sclater) for 1934 wrongly assumed that was the locality. Moreover, it only cited page 421 of the paper, where this subspecies is simply mentioned casually as 'luxurious' and 'large'. The full description and locality follow, after a long digression, on pages 424–425.

The upperside appearance of the male is unmistakeable; deep shining blue with simple black borders to the fore wing. The fore wing underside is chocolate-brown. The female fore wing underside is pure deep orange, with the bands strongly outlined in black. Its upperside is brown as usual, with traces of orange in the disc.

A male specimen ex coll. Oberthür now in the BMNH is of unusual interest. Set upside down, its upperside has been hidden by the labels which read '*Ravindra* Horsf., Java/ex Musaeo Dris. Boisduval/*Myrina ravindra* Boisd./*Species G'al.* pl. 22, fig. 1'. Boisduval's figure was cited as 'Java, Horsfield', but this specimen, apparently the one whose underside is figured, is certainly not Javanese; it is a typical *sumptuosa*. While Horsfield was serving the Dutch (1801–1810) and the British (1811–1819) in Java he made several visits to Sumatra (D.N.B.), and in 1818 he accompanied Raffles on an inland expedition from Bencoolen [Bengkulu], doing much collecting (Stanley, 1971 : 87). This specimen, which bears evidence of age, must have been collected then, mixed with Javanese material, treated as a duplicate and set upside-down by Horsfield, and then passed by him to his correspondent, Boisduval (perhaps when the latter visited London in 1835).

MATERIAL EXAMINED.

*Marmessus ravindra sumptuosa* 'parallotype', INDONESIA: Moeara Malisom, 50 m. Bengkulu, ♀, vi. 1931 (*van der Pijl*) (Rijksmuseum van Natuurlijke Historie, Leiden).

INDONESIA: Lebong Tandai [90 km N.N.W. of Bengkulu], 19 ♂, 22 ♀, 1921–1923 (*C. J. Brooks*); 'Barisan Range, western slope', 2500 ft, 1 ♀ (*C. F. & J. Pratt*); 'Java' [Bengkulu] [1818] (*Horsfield*, ex coll. Boisduval), 1 ♂.

### ***Drupadia ravindra janus*** (Riley) **comb. n.**

(Text-fig. 1; Pl. 1, figs 25, 37)

*Marmessus lisias janus* Riley, 1944 : 266. Holotype ♂, INDONESIA: S.W. Sumatra (BMNH) [examined].

Located midway between the territories of *rav. sumptuosa* and *rav. ravindra*, this subspecies is interesting in that the male fore wing upperside not only has the base blue, but also half the specimens have a dusky orange discal patch. The female fore wing underside is still bright orange, so the transition from here to west Java, where it is chocolate-brown like the male, is sudden.

All but one of Doherty's long series bear Oberthür's printed labels 'Marang (or Liwa), S.O. Sumatra, 1890', but one male has both a ms. label 'Marang' and also a printed one (not Oberthür's) reading 'Enggano, Sep. 1890, Doherty'. It is slightly smaller and darker, and has no trace of orange. Doherty collected in Enggano immediately after leaving Marang, but he did not include this species in his Enggano list (Doherty, 1891). However, it may be that another subspecies awaits rediscovery there. There are two dwarf males in the main series, one with and one without the orange patch.

Oberthür was French, and his 'S.O.' means *sud-ouest* (S.W.), not the German *sud-öst* (S.E.) which Fruhstorfer would mean by it. Marang and Liwa are respectively coastal and inland, both close to Krui.

MATERIAL EXAMINED.

*Marmessus lisias janus* Riley, holotype ♂, INDONESIA: S.W. Sumatra, Marang, 1890 (*W. Doherty*).

Paratypes. Allotype ♀, 38 ♂, 18 ♀, INDONESIA: S.W. Sumatra, Marang, 1890 (*W. Doherty*); 2 ♀, Liwa, 1890 (*W. Doherty*).

INDONESIA: S.W. Sumatra, 1 ♂, Krui, iv–vii. 1897 (*collector F*, ex coll. Van der Poll).

### ***Drupadia ravindra ravindra*** (Horsfield) **comb. rev.**

(Text-fig. 1; Pl. 1, figs 26, 38)

*Thecla ravindra* Horsfield, 1828 : pl. 1, figs 11, 11a, explic. p.1. Holotype ♂, INDONESIA: Java (BMNH) [examined].

*Myrina ravindra* (Horsfield); Horsfield, 1829 : 117, no. 47.

*Drupadia ravindra* (Horsfield); Moore, 1884 : 31.

*Marmessus ravindra ravindra* (Horsfield); Fruhstorfer, 1912 : 250.

*Marmessus ravindra medullia* Fruhstorfer, 1912 : 250. LECTOTYPE ♂, here designated, INDONESIA: S.E. Java (BMNH) [examined]. [Synonymised by Kalis, 1933 : 86.]

*Drupada ravindra* (Horsfield); Piepers, 1921 : 105, pl. 27, figs 168a, b, c. [genus misspelt].

*Marmessus ravindra* (Horsfield); Seitz, 1926 : 990, pl. 159, fig. g1 (as '*jalindra*' on plate).

*Marmessus medullia* Fruhstorfer; Seitz, 1926 : 990, pl. 159, figs g4, g5.

*Biduanda thesmia javanica* Toxopeus, 1932 : LXX. 1 ♂, 1 ♀ syntypes, INDONESIA: Java (not located). [Aberration.] **Syn. n.**

*Marmessus ravindra ravindra* (Horsfield) var. *transiens* Kalis, 1933 : 86.

The male is typically large, with the fore wing upperside plain black and the hind wing unmarked except for the black costal border above vein 6. The female upperside is plain dark brown. The fore wing underside is chocolate-grey, very slightly browner in the female. The commoner form is smaller, with the male hind wing upperside more or less suffused black at the base, the apex, and along the dorsum, with a streak at the cell end.

Horsfield's main home during his stay in Java was central, at Surakarta, whence he collected extensively for over fifteen years throughout the island. His 1829 text covers specimens of both forms, with expanse '11–17 lines' [=23·5–36 mm, or fore wing length about 13–20 mm], but for his illustration and holotype he selected the largest male. His 1828 plate was reproduced by Stanley (1971 : 86).

Fruhstorfer found the smaller, darker form commonly in east Java, and concluded it was a distinct subspecies which he named *medullia*. His description of the female hind wing upperside as 'monoton grau' was clearly a lapsus, for it is uniform dark brown. He appears to have made three visits to Java, an extensive one in 1891–1893 and short ones in 1890 and from late 1896 to early 1897. His label data are perfunctory; simply 'West Java', 'East Java', or 'Java merid. [South]', with the year only. One exception reads 'Java merid., Pelaboean, 1892'. *Labuan* or *laboean*, with or without the affix '*Pe-*' means an anchorage or harbour, a frequent place name but in Java applied to Pelaboean Ratoe, or Wijnkoops Bay, in the south-west. All his other 'Java merid.' labels are assumed to refer to the south-east, where Fruhstorfer did much collecting. He summarised his localities in a brief outline of his main tour, but gave no dates (Fruhstorfer, 1897 : 308–309).

In the BMNH type collection are two specimens labelled '*medullia* Fruhst. Type'; a male with 'Java merid., 1896' and a female with merely 'Java orient.'. I now designate the male as lectotype of *Marmessus ravindra medullia* Fruhstorfer, with locality the coastal hills south of the Tengger Mountains, S.E. Java.

Several Fruhstorfer specimens appear to have had yellow BMNH paratype labels added but, excepting one, without identities. All are presumably from his *medullia* series. They are:

1 ♂; Java merid., Pelabuan, 1892 [but S.W. Java was not the type locality].
1 ♀; Java merid., 1500 ft, 1896 (S.E. Java].
1 ♂; Java orient., Montes Tengger, 2000 ft, 1890/*medullia* Fruhst.
1 ♂; Java orient.

The first being large and *ravindra*-like.

Another male, labelled; 1590 ♂, Lawang [E.] Java (*Holtz*); and Swinhoe coll. 1916 [printed in red]; Joicey Bequest; bears a green BMNH Allotype label with no further data. This can be linked with no published name at all.

Kalis, with good material, found that the species varied in Java between the large, typical *ravindra*-like form from August to March, and the small *medullia*-like form from April to June. He consequently argued that the name *medullia* was untenable in a subspecific sense. Thus *D. r. ravindra* may be considered to comprise the forms *ravindra* Horsfield, *medullia* Fruhstorfer, and the intermediate *transiens* Kalis.

The specimens described by Toxopeus were a male and a female from Radjamandala [W. Java, 30 km north-west of Bandoeng], very like *D. r. ravindra* but possessing fore wing vein 9. Although noting that they were unlike any known '*Biduanda*' [species with vein 9], and suggesting that they might be monstrosities, he deliberately named them as a subspecies of *B. thesmia* [*D. theda*]. I have not seen these specimens, but from the description it seems clear that they are minor aberrations of *D. r. ravindra*. From an examination made in 1954 of nearly 600 specimens of *D. ravindra* from various localities between Burma and Palawan, it was found that about six per cent of each sex had vein 9 present in the fore wings, a further two per cent having it in one wing only, although in most cases it is very short.

Piepers figured the larva and pupa, but erroneously (I am sure) stated that the pupa was secured by a median thread. His text was copied by Seitz. Piepers said he did not look for ant-association because such symbiosis was unknown until after he had left Java. One assumes that he did not rear the insect *ab ovo*.

MATERIAL EXAMINED.

*Thecla ravindra* Horsfield, holotype ♂, INDONESIA: Java [1801–1818] (*Horsfield*). *Marmessus ravindra medullia* Fruhstorfer, lectotype ♂, INDONESIA: S.[-E.] Java, 1896 (*Fruhstorfer*).

INDONESIA: 9 ♂, 7 ♀, Java; 16 ♂, 21 ♀, West Java; 6 ♂, 16 ♀, S.W. Java; 13 ♂, 9 ♀, East Java; 1 ♂, 6 ♀, S.[-E.] Java.

[1 ♂, Lombok, requires confirmation. 1 ♂, 1 ♀, 'Bandjamassin, S.E. Borneo', ?err. loc.]

### **Drupadia ravindra balina** (Fruhstorfer) **comb. n.**

*Marmessus ravindra balina* Fruhstorfer, 1914 : 175. LECTOTYPE ♂, here designated, INDONESIA: Bali (BMNH) [examined].
*Marmessus balina* Fruhstorfer; Seitz, 1926 : 990, pl. 159, fig. g2.

The illustration by Seitz shows an unusually blue male. The hind wing upperside is normally black bordered along the entire termen and, if any blue extends to the cell, the cell-end veins are heavily blackened. The underside is darker than that of *D. r. medullia*.

Fruhstorfer's male and female syntypes, and a second female, have the same data, and I now designate the male as lectotype of *Marmessus ravindra balina* Fruhstorfer.

The BMNH series is remarkably constant (except for size), no doubt because most were taken at the same time.

MATERIAL EXAMINED.

*Marmessus ravindra balina* Fruhstorfer, lectotype ♂, INDONESIA: Bali, ix. 1906 (*Fruhstorfer*).

Paralectotypes. Syntype ♀, 1 ♀, INDONESIA: Bali, ix. 1906 (*Fruhstorfer*). INDONESIA: Bali, 5 ♂, 7 ♀, iii–iv. 1806 (*W. Doherty*).

### **Drupadia ravindra banka** (Riley) **comb. n.**

[*Sithon lisias boisduvalii* (Moore); Snellen, 1890 : 299. Belitung.]
*Marmessus lisias banka* Riley, 1944 : 267. Holotype ♂, INDONESIA: Bangka Island (BMNH) [examined].

This is a most richly coloured subspecies. The male hind wing upperside is clear deep blue, shot with dark violet when viewed from any angle except in front. The orange patch is bright and prominent in both sexes. The hind wing underside is more heavily marked than usual, and the subtornal reddish bars, which are normally a character of *D. rufotaenia*, are often well developed. In contrast, the fore wing underside markings are not prominent.

The fine series collected by Dr Hagen (ex coll. Rothschild) ranges in fore wing length from 18 mm down to 12 mm (a very heavily marked male), and 11 mm (two females, one perhaps a *D. rufotaenia*).

The otherwise distinct possibility that the two syntypes of *Papilio lisias* Fabricius (see *D. rav. corbeti* above) might have been collected during the laborious tacking of the *Resolution* and the *Discovery* through the tortuous Bangka Strait can now be ruled out by their faint brown markings on the hind wing underside.

Snellen's record of specimens from the neighbouring island of Belitung, having smaller orange patches on the fore wing than *D. rav. boisduvalii* and with the hind wing underside markings darker, suggest that this subspecies occurs there also.

MATERIAL EXAMINED.

*Marmessus lisias banka* Riley, holotype ♂, INDONESIA: Bangka Is, Soengei Liat (*Van der Poll*).

Paratypes. Allotype ♀, 1 ♂, 1 ♀, INDONESIA: Bangka Is, Soengei Liat (*Van der Poll*).

INDONESIA: Bangka Is, 15 ♂, 17 ♀, 1891 (*Hagen*).

### ***Drupadia ravindra lisiades*** (Fruhstorfer) **comb. n.**

*Sithon ravindra* (Horsfield) var.; Staudinger, 1888 : 277, pl. 95. Sarawak.
*Marmessus lisias lisiades* Fruhstorfer, 1912 : 248. 2 ♂ syntypes, EAST MALAYSIA: Sabah, Mt Kina Balu (not located).
*Marmessus lisiades* Fruhstorfer; Seitz, 1926 : 989, pl. 159, fig. d1.

Fruhstorfer's description was of two males which have not been traced. This subspecies has the same underside, with a bright orange fore wing, as both *D. r. moorei* (Pl. 1, fig. 34) and *D. r. fulminans* (Pl. 1, fig. 31), but compared with their uppersides (Pl. 1, figs 22, 19) it is intermediate, having a small but well marked orange fore wing patch. It differs from both in the peculiar chalky blue of the hind wing upperside (a feature not well shown in the cited illustrations).

Moulton (1911 : 165) mentioned the uppersides of the long Sarawak Museum series which nicely linked *D. r. moorei* with its plain black fore wing and *D. r. fulminans* ('*atra*') with its large orange patch, but he did not refer to the hind wing colour. His intermediates probably included the then unnamed *D. r. lisiades*.

*D. r. moorei* appears to inhabit west Kalimantan, Sarawak and north Sabah, *D. r. fulminans* occurring from east Sabah through east Kalimantan round the south and west coasts. *D. r. lisiades* has been found mainly in the west and north; it may be an inland race, but its status requires investigation.

MATERIAL EXAMINED.

MALAYSIA: 2 ♂, Sabah; 8 ♂, 11 ♀, Sarawak. INDONESIA: West Kalimantan, 1 ♂, 4 ♀, Pontianak (Ledru & Mulot, 1897); 2 ♂, 1 ♀, Lohaban[g] (0°48′N., 109°02′E., the westernmost point of Kalimantan).

### ***Drupadia ravindra fulminans*** (Staudinger) **comb. n.**

(Pl. 1, figs 19, 31)

*Sithon moorei fulminans* Staudinger, 1889 : 109. Type-material, INDONESIA: South Kalimantan (not located).
*Marmessus boisduvalii* (Moore) var. *atra* Druce, 1896 : 679. Type-material, EAST MALAYSIA: East Sabah (not located). **Syn. n.**
*Marmessus fulminans* (Staudinger); Seitz, 1926 : 989, pl. 146, figs g2, g3, pl. 159, fig. d4.
*Marmessus atra* Druce; Seitz, 1926 : 989.

No primary type-material of these two nominal taxa has been found, but the male figured on Pl. 1 (Sapagaya, a river running north into Sandakan bay, 15.ix.1894 [*Cator*]) must have been a paratype of *D. r. atra*. Seitz deduces that Druce's name *atra* was for a dark form of *D. r. fulminans* but this was not so. Druce did not know Staudinger's insect, and his seemingly incongruous name simply denoted the black markings on the hind wing underside as compared with those of what he called *Marmessus boisduvalii*, which are orange-brown.

This is another very vivid subspecies in the male. The orange area on the fore wing upperside is extensive and intense, and the hind wing is very deep violet. The females of this and of *D. r. lisiades* are very similar, dark brown with an orange patch which is smaller in the latter.

The territories in Borneo/Kalimantan of three subspecies, including this one, have been discussed under *D. r. lisiades* above. They seem to radiate to the west and south. Under the next subspecies, *D. r. surindra*, two further forms which radiate eastwards will have to be dealt with.

MATERIAL EXAMINED.

EAST MALAYSIA: 2 ♂, 1 ♀, Sabah, Sandakan. INDONESIA: 11 ♂, 2 ♀, S.E. Kalimantan; 4 ♂, 1 ♀, Pulo Laut, S. Kalimantan; 2 ♂, 1 ♀, West Kalimantan, Sintang.

### ***Drupadia ravindra surindra*** (Druce)

(Pl. 1, figs 23, 35)

*Marmessus surindra* Druce, 1895 : 617, pl. 34, fig. 7. Holotype ♂, EAST MALAYSIA: Sabah (BMNH) [examined].
*Marmessus surindra* Druce; Seitz, 1926 : 990, pl. 156, figs g7, h1.
*Drupadia* (*Marmessus*) *ravindra surindra* (Druce); Barlow, Banks & Holloway, 1971 : 293.

The uppersides of all the remaining subspecies are without an orange patch, and the male hind wing blue or violet-blue not only extends to the costa but is uniform in colour and has no contrasting reflection, while the two tornal black spots are absent. Consequently the male upperside shows two cleanly contrasted colours. In the slightly aberrant specimen selected for Pl. 1, the bright blue of the typical hind wing reappears in a series of submarginal streaks at the fore wing tornus. Several Sabah specimens are so marked; a departure from the normal variation trends. The female of this subspecies is particularly distinctive in having the tornal third of the hind wing upperside almost pure white. In all the remaining eastern subspecies the tornus has only a narrow blue line round the two tornal black spots.

Druce's original series was from 'Kina Balu (*Waterstradt*), Sandakan (*Pryer*), S.E. Borneo (*Wahnes*)'. His holotype from Sandakan is rather small but otherwise similar to Kina Balu specimens; others from Sandakan and particularly two Wahnes males from S.E. Kalimantan are smaller still and have very dusky hind wings. Their upperside approaches that of *D. r. joloana*, but they do not have the latter's very pale underside. They seem intermediates; perhaps expatriate dwarfs.

MATERIAL EXAMINED.

*Marmessus surindra* Druce, holotype ♂. EAST MALAYSIA: Sabah, Sandakan [*Pryer*].

MALAYSIA: Sabah; 2 ♂, Melaman, 1000 ft (*Woollett*); 4 ♂, 4 ♀, Kina Balu; 30 ♂, 30 ♀, Kina Balu, v–viii. 1903 (*Waterstradt*, late visit); 4 ♂, 4 ♀, Sandakan; 3 ♂, 4 ♀, various.

### ***Drupadia ravindra joloana*** (Staudinger) **comb. n.**

(Pl. 1, figs 27, 39)

*Sithon joloana* Staudinger, 1889 : 109. Type-material, PHILIPPINES: Jolo Is. (not located).
*Marmessus surindra* var. *albula* Druce, 1895 : 617. LECTOTYPE ♀, here designated, EAST MALAYSIA: Sabah (BMNH) [examined]. **Syn. n.**
*Marmessus ravindra joloana* (Staudinger); Fruhstorfer, 1912 : 250.
*Marmessus joloana* (Staudinger); Seitz, 1926 : 990, pl. 159, fig. g3.
*Marmessus albula* Druce; Seitz, 1926 : 990.

Druce described both sexes from Sandakan, but he apparently did not read Staudinger's description of *Sithon joloana*, with which they agree. He noted the differences from the male *D. r. ravindrina*, of which he had Staudinger's 'type' before him. Seitz in his turn misinterpreted Druce, saying that in var. *albula* the fore wing ground colour is plain white below. The termen is narrowly shaded ochreous, as shown in his good illustration of *D. r. joloana*.

In the BMNH type collection is only a female from coll. Druce, labelled '*surindra* var. *albula* H. H. Druce', and with a modern green 'allotype' label. There is no indication when the latter was added; presumably another syntype then existed and was a male, but is now lost. I therefore now designate this female as lectotype of *Marmessus surindra* var. *albula* Druce. Its data label reads 'Sandakan (*Pryer*)'.

Although Druce said it appeared to be common at Sandakan, there is only one other specimen in the BMNH from the Borneo mainland. *D. r. joloana* seems to be endemic in the Sulu Islands and epidemic on nearby coasts.

MATERIAL EXAMINED.

*Marmessus surindra* var. *albula* Druce, ♀ lectotype. EAST MALAYSIA: Sabah; Sandakan (*Pryer*).

PHILIPPINES: 2 ♂, 3 ♀, Jolo (*Fruhstorfer*); 1 ♀, Sibutu, vii. 1893 (*Everett*); 1 ♀, Palawan (*Platen*). EAST MALAYSIA: Sabah; 1 ♀, Sandakan; 1 ♂, 1 ♀, Banguey [Banggi], x. 1894 [*Cator*].

Note. The Banggi pair has the underside darker, approaching *D. r. surindra*, and may represent an intermediate subspecies.

### ***Drupadia ravindra ravindrina*** (Staudinger) **comb. rev.**

*Sithon ravindra* var. *ravindrina* Staudinger, 1889 : 108. Holotype ♂, PHILIPPINES: Palawan (BMNH) [examined).
*Drupadia ravindrina* (Staudinger); Semper, 1892 : 354.
*Marmessus ravindrina* (Staudinger); Fruhstorfer, 1912 : 250.
*Marmessus ravindrina* (Staudinger); Seitz, 1926 : 990, pl. 159, figs g6, g7.

The only differences between this and the next subspecies on the upperside are in the hind wing, which is slightly deeper violet-blue in the male, while in the female the tornal lunules are clear bright blue; indeed in some specimens they are double, two blue arcs separated by a black line. On the underside the fore wings are not quite so pale and the hind wing black markings, smaller than in all preceding subspecies, are not so small as in *D. r. resoluta*.

MATERIAL EXAMINED.

*Sithon ravindra* var. *ravindrina* Staudinger, holotype ♂, PHILIPPINES: Palaw[an] (*Pl*[*aten*]).

PHILIPPINES: 11 ♂, 17 ♀, Palawan Is. (*Doherty*, *Everett*, *Cator*, *Wileman*, *et al.*); 5 ♂, 9 ♀, Balabac Is. (*Everett*, *Cator*).

### ***Drupadia ravindra resoluta*** **subsp. n.**

(Pl. 2, figs 49, 52)

As usual, the head, eyes, antennae and upperside of the body are very dark brown except for the apical half of the antennal club which is orange-brown, and the following which are white: each joint of the antennae, the basal half of each palp, a narrow ring round each eye, and the frons. The underside of the body is white and the legs are white with a black ring at each joint.

*Wings; upperside.* The male fore wing is plain black, and the hind wing is rich shining violet-blue except for the greyish white brand, and the dorsum below vein 1 and the costa above vein 7 which are brown. The female is very dark brown. On the hind wing of both sexes the usual black marginal hairline, inwardly edged white, and the white terminal cilia, are conspicuous. The tails are black centred and edged with white, and the two black subtornal spots are obsolete in the male but distinct and crowned with diffuse blue-grey lunules in the female.

*Underside.* The fore wing is dull creamy orange, paler in the female, and marked as usual; a blackish, white-edged streak along the basal fifth of the cell, a similar dark brown one across the centre of the cell with a small black spot below it, a narrow orange cell-end bar, and a very narrow postdiscal band which fades apically into the ground colour, as does the submarginal line above vein 2. The hind wing is white with the usual black markings greatly reduced; an oblique sub-basal stripe from the base of the dorsum to the origin of vein 8, a more or less parallel series of five spots, the first three contiguous, the fourth mid-cell, the fifth across space 7 above the origin of vein 7; a third row of four spots consisting of a horizontal bar from vein 1a to mid vein 1, a bar below the origin of vein 2, the cell-end bar, and a bar across the centres of spaces 6, 7; the outer pair of these are actually the ends of the postdiscal series whose other five spots curve between them; a U-shaped line in space 1, and short bars across the centres of spaces 2, 3, and 4–5. Due to the reduced size of these markings there is an abnormally wide space before the submarginal and marginal black lines which, as usual, run very close and parallel between the end of vein 1a and vein 1 and which in that space are edged with reddish orange. The usual black eye-spot in space 2 and tornal lobe are surrounded by sparse metallic blue scales.

The differences between this and the nearest other subspecies are noted under *D. r. ravindrina* above.

Staudinger (1889 : 108) knew of one specimen from Luzon, but Semper (1890 : 354) said he had never found the species east of Palawan. This subspecies must be very rare. The Luzon specimen in the BMNH is identical to Mindoro specimens.

MATERIAL EXAMINED.

Holotype. [PHILIPPINES:] Mindoro, ♂, xii. 1894 (*Everett*).

Paratypes. [PHILIPPINES:] Mindoro, 2 ♂, 3 ♀, xii. 1894 (*Everett*); [Luzon], near Manila, 1 ♂, i. 1895 (*Everett*); Mindoro, 2 ♂ (no further data).

### ***Drupadia rufotaenia*** (Fruhstorfer) **comb. n.**

(Text-figs 12–15; Pl. 2, figs 43, 47; Pl. 3, figs 61–68; Pl. 5, fig. 101)

*Marmessus rufotaenia* Fruhstorfer, 1912 : 249.

The characteristics of this little species, and its similarity in nearly every subspecies to dwarf females of *D. ravindra*, have been noted already (pp. 291, 293, 297, 302). Except in Burma it is extremely rare, and it is tempting to regard it as a morph of that species, but two features preclude this on present knowledge; its greatly different male genitalia, and the fact that in Burma, whence there is a long series, the differences are quite constant.

The name, 'red ribbon' (*taenia rufa*), refers to the prominent extension of the brick-red outer edging to the subtornal black line which encloses the metallic blue scaling round the hind wing underside eye-spots. This character is a useful but not infallible guide; it is less distinct in females (where it is most needed) and, often faintly discernible in *D. ravindra*, it is sometimes quite well developed in heavily marked specimens of that species. It is not necessarily always red, tending to follow the variation in fore wing ground colour, and if the occurrence of

*D. rufotaenia* in Java is confirmed, the ribbon may well prove there to be chocolate.

The only certain diagnostic of *D. rufotaenia* on present knowledge is the aspect of the male genitalia, whose large size necessitates, and betrays its presence by, the correspondingly long abdomen.

The underside markings are exactly as in *D. ravindra* and, having just been described under *D. rav. resoluta*, will not be detailed again. Subspecies differ in the colour of the fore wing underside and, on the upperside, in the presence or absence of the fore wing orange patch and in the nature of the tornal pale area on the hind wing.

The range as hitherto recorded was from Burma to the Malaysian peninsula, Sumatra and Java. Java was included on the basis of two males which on dissection have proved to be *D. ravindra* dwarfs, both so identifiable at sight as each has some residual shining blue scaling on the hind wing upperside. But there is in the BMNH one Java female which may well prove to be this species, if it can be confirmed by discovery of a male. It will, as might be expected, then require a new name, as the fore wing underside is dark chocolate.

The range of *D. rufotaenia* can, however, now be more than doubled. Definite male specimens have been identified from Nias, north and south Borneo, Palawan, and Mindoro. I have the personal impression that it favours open lowland forest rather than deep jungle, and it should be sought wherever *D. ravindra* occurs.

### KEY TO SUBSPECIES OF *D. rufotaenia*

(Pl. 2, figs 43, 47; Pl. 3, figs 61–68)

1 Fore wing underside pale to intense orange . . . . . . . . . 2
– Fore wing underside either heavily suffused with grey, or other than orange, at least in the male . . . . . . . . . . . . . 6
2 Upperside dark brown with an extensive orange discal area on the fore wing **ruf. archbaldi** (Evans) (p. 316)
– Fore wing upperside unmarked . . . . . . . . . . . 3
3 Fore wing underside deep orange (peninsular Malaysia) (figs 43, 47) **ruf. rufotaenia** (Fruhstorfer) (p. 316)
– Fore wing underside pale dull orange . . . . . . . . . 4
4 Hind wing upperside with the tornal quarter very pale greyish white (Sabah) (figs 62, 66) . . . . . . . . . **ruf. kina** subsp. n. (p. 318)
– Hind wing upperside without a wide pale area . . . . . . . 5
5 Hind wing underside with the chequered spots normal. Male hind wing upperside with a submarginal series of blue spots (Palawan) (figs 63, 67) . **ruf. torquata** (p. 318)
– Hind wing underside with the chequered markings much reduced. Upperside plain (Mindoro) (figs 64, 68) . . . . . . . **ruf. praecox** subsp. n. (p. 319)
6 Fore wing underside orange, heavily suffused with grey in the male. Fore wing upperside with an orange patch and with its basal third, and the tornal half of the hind wing, very pale grey (Nias) (figs 61, 65) . **ruf. caesia** subsp. n. (p. 317)
– Male fore wing underside deep greyish brown in the apical half (female unknown, but probably orange). Fore wing upperside plain; hind wing with the tornal quarter suffused with pale dull (not shining) greyish blue (S.W. Sumatra) **ruf. alcyma** (Riley) (p. 317)

### ***Drupadia rufotaenia archbaldi*** (Evans) **comb. n.**

*Marmessus archbaldi* Evans, 1932 : vi, 290, no. H73.2. Holotype ♂, Burma: Dawna Hills (BMNH) [examined].
*Marmessus rufotaenia archbaldi* Evans; Corbet, 1948 : 102.

Discovered independently by Evans, who named it after its first captor, Mr W. Archbald of Burma, this subspecies was not identified with *rufotaenia* for sixteen years.

This subspecies ranges through Burma and Thailand, from about 21°N. to the Kra Isthmus. Like *D. rav. boisduvalii* females, the upperside is dark brown with a few grey scales at the hind wing tornus, and with an extensive orange area on the fore wing. This area is largest in the north, where discal spots of orange may appear on the hind wing as well, and it gradually decreases until in north Malaysia only a vestige remains.

Material examined.

*Marmessus archbaldi* Evans, holotype ♂, Burma: Dawnas [16°30′N., 98°30′E.], i. 1921 (*W. H. Evans*).

Burma: 14 ♂, 11 ♀, Shwenyaung [20°48′N., 96°58′E.] southwards to Mergui. Thailand: 1 ♀, Phrae Dist., Me Tharn, iv. 1918; 1 ♀, Nong Khai Ploy, 20.iv.1914 (both *E. J. Godfrey*); 3 ♂, 1 ♀, Ranawng (*Doherty*).

### ***Drupadia rufotaenia rufotaenia*** (Fruhstorfer) **comb. n.**

(Pl. 2, figs 43, 47)

[*Drupadia moorei* var.; Distant, 1886 : 460, pl. 44, fig. 11.]
*Marmessus rufotaenia* Fruhstorfer, 1912 : 249. Holotype ♂, West Malaysia: Malacca (not located).
*Marmessus rufotaenia* Fruhstorfer; Seitz, 1926 : 990.
*Marmessus rufotaenia rufotaenia* Fruhstorfer; Corbet, 1948 : 102.
*Marmessus rufotaenia rufotaenia* Fruhstorfer; Eliot, 1959 : 382.

The figures on Pl. 2 are given alongside a similar-sized dwarf *D. rav. moorei* from Singapore for comparison.

Distant's excellent figure was published with the notes that the specimen was a female from Malacca in coll. Staudinger. It has not been located. To him it would naturally appear to be a female but now, knowing that the sexes are similar, it seems probable that it was a male, with the long slim abdomen, slightly dilated before the acutely tapered apex, well shown in the illustration.

Fruhstorfer named the species from Distant's figure and said that he knew of no other specimen, so Staudinger's lost specimen is the holotype. He suggested it was related to what he called *Marmessus niasica* Röber, but Röber's very clear photograph shows that his *Sithon niasica* was marked like *D. theda* on the hind wing underside and it should have been grouped by Fruhstorfer among the *Biduanda* species. The type-locality has in the past wrongly been given as Singapore.

The upperside is plain very dark brown. Normal specimens are found throughout the Malay peninsula, in Singapore, north-east Sumatra and northern Borneo. The transition to the Burmese subspecies *archbaldi* Evans commences in the Langkawi Islands, where the fore wing has a small orange flash (Eliot, 1959).

MATERIAL EXAMINED.

WEST MALAYSIA: 1 ♀, Penang (*Adams*); 1 ♀ [Pahang], Mt Tahan (*J. Waterstradt*); 1 ♀, Pahang, Telom R., ii. 1932 (*Capt. Holloway*); 1 ♂, Trengganu, Tebu F.R., 4.v.1958 (*J. A. Hislop*) (coll. Hislop); 1 ♂, Pulo Tioman, 14.v.1959 (*G. C. Stubbs*) (coll. Stubbs); 2 ♀, Johore, Endau, 17.ix.1957, 26.x.1958 (*G. C. Stubbs*) (coll. Stubbs); 1 ♂ [Negeri Sembilan], Seremban, 6.ix.1958 (*H. L. Lewis*). SINGAPORE: 1 ♂, MacRitchie Reservoir, 17.xii.1936 (*C. F. Cowan*); 1 ♀, Nee Soon, 27.vii.1952 (*id.*); 1 ♀ (?) (reared from larva), 6.i.1955 (*R. C. R. Morrell*). INDONESIA: N.E. Sumatra, 3 ♀ [Medan area] [c. 1893] (*Martin*). EAST MALAYSIA: E. Sarawak, 1 ♀, Limbang R., vii. 1891 (*A. H. Everett*); W. Sabah, 1 ♂, Lumbidan, iii. 1892 (*A. H. Everett*).

Notes. The five ♂♂ are positive identifications, the eleven ♀♀ only presumptive. Regarding the ♀ reared by Morrell, see the remarks on page 297 above.

Also examined: 4 ♂, 3 ♀, extreme dwarf *D. rav. moorei* (fore wing lengths 11–13 mm) in colls J. N. Eliot, G. C. Stubbs, and J. A. Hislop, from Langkawi Is. and peninsular Malaysia.

Lumbidan is one of four Everett localities 'on the coast of Borneo immediately opposite [the northern end of] Labuan' (Everett, 1889 : 93). The only map showing it which I have found is Frank Hatton's (Hatton, 1886).

### ***Drupadia rufotaenia alcyma*** (Riley) **comb. n.**

*Marmessus archbaldi alcyma* Riley, 1944 : 267, pl. 1, fig. 3. Holotype ♂, INDONESIA: S.W. Sumatra (BMNH) [examined].
*Marmessus rufotaenia alcyma* Riley; Corbet, 1948 : 102.

Among about 60 specimens of *D. rav. janus* which William Doherty collected at Marang and Liwa, Riley detected two males of this species.

As usual, they closely resemble the female of the former on the upperside, and the male on the underside. The female fore wing underside will probably prove to be deep orange, as in the *D. rav. janus* female.

MATERIAL EXAMINED.

*Marmessus archbaldi alcyma* Riley, holotype ♂, paratype ♂, INDONESIA: S.W. Sumatra, Marang [viii–ix] 1890 (*W. Doherty*).

### ***Drupadia rufotaenia caesia*** **subsp. n.**

(Pl. 3, figs 61, 65)

The upperside (fig. 61, male) of both sexes, and the underside of the female, are delightful miniatures of the very distinctive *D. rav. caesarea* female. The male underside (fig. 65), with the distal half of the fore wing heavily clouded with grey, resembles the Nias male of the larger species. The fore wing length is 11 mm.

MATERIAL EXAMINED.

Holotype ♂, INDONESIA: Nias Is. [probably ix–x. 1897] (*Raap*).

Paratypes. INDONESIA: Nias Is., 1 ♀ (*Raap*); 1 ♀ (*Van der Poll*).

Notes. Regarding Hugo Raap's botanical visit to Nias, see Raap, 1903.

Before leaving the Sumatra area, it is noted that two female specimens in the BMNH from Banka Is, among several intermediate dwarf *D. rav. banka*, may represent a further subspecies there.

### ***Drupadia rufotaenia kina*** **subsp. n.**

(Pl. 3, figs 62, 66)

The holotype and one apparently corresponding female only are known. The upperside of each is very dark brown with the tornal third of the hind wing very pale greyish white (exactly as in the female of *D. rav. surindra*). On the fore wing underside the male shades from white at the base to ochreous grey, and the female from white to pale ochreous at the termen (exactly as in the respective sexes of *D. rav. surindra*). The fore wing length in this rather large subspecies is 12–13 mm.

Like the western *D. rav. moorei* and the eastern *D. rav. surindra*, so *D. ruf. rufotaenia* and *D. ruf. kina*, appear to share a slight overlap in western Sabah. In each species the eastern subspecies seems, on the scanty data available, to frequent the foothills.

MATERIAL EXAMINED.

Holotype ♂, EAST MALAYSIA: Sabah, Kina Balu (*Waterstradt*).

Paratype, ♀, EAST MALAYSIA: Sabah, Kretam [coastal hill 65 km south-east of Sandakan], 14.vii.1950 (*J. D. H. Hedley*).

### ***Drupadia rufotaenia torquata*** **subsp. n.**

(Pl. 3, figs 63, 67)

This is a distinctly large subspecies, and the male genitalia (of the holotype), although of typical pattern, are correspondingly larger in all parts. The fore wing length is 14 mm. The male upperside markings are unusual.

The upperside is very dark brown, as might be expected, with two small dull blue subtornal lunules on the hind wing. In the male these two spots are ovate instead of crescentic, and are repeated as a series in spaces 3 and 4 and, in the holotype, space 5.

The underside is exactly as in *D. rav. ravindrina* from Palawan, with the fore wing dull orange, paler in the female.

MATERIAL EXAMINED.

Holotype ♂, PHILIPPINES: Palawan [*D. Cator*].

Paratypes. PHILIPPINES: 1 ♂, 2 ♀, Palawan, viii–ix. 1894 [*Cator*]; 1 ♂, 1 ♀, Palawan; 1 ♀, Balabac, x. 1894 [*Cator*].

### ***Drupadia rufotaenia praecox*** **subsp. n.**

(Pl. 3, figs 64, 68)

Alfred Hart Everett collected the unique male at the same time as his series of *D. rav. resoluta*. It is very small, perhaps a small individual representing a normally-sized population.

The upperside is plain dark brown, unmarked (fig. 64, which inevitably exaggerates every blemish). The fore wing underside is rather dull orange, and the markings on the hind wing underside, like those of *D. rav. resoluta*, are considerably reduced.

The fore wing length is 9·5 mm.

MATERIAL EXAMINED.

Holotype ♂, PHILIPPINES: Mindoro, xii. 1894 (*Everett*).

### ***Drupadia cinderella*** **sp. n.**

(Text-fig. 6; Pl. 2, figs 54, 58; Pl. 5, fig. 102)

The male fore wing dorsum and hind wing costa are strongly lobed, and the fore wing dorsal margin bears an underlying row of long black hairs which are directed forward to cover an ovate nacreous area round the central half of vein 1. The hind wing upperside has a large brown sub-basal brand filling the bases of spaces 6 and 7, which slightly distorts the radial vein before the origin of vein 7. In all normal positions of the wings the long black hairs are quite hidden between the wing lobes, and are interposed between the nacreous area and the brand. The fore wing length is 16 mm in both sexes.

The male upperside is black, with the tornal half of the hind wing shining bright blue bordered by a black marginal hairline and white cilia. The female is similar but dark brown and greyish white. The tails are white, with a black centre line, and there are the usual two black subtornal spots.

The underside is deep ochreous with traces of darker cell-end and postdiscal lines which are outwardly edged white; the tornal half of the hind wing is white, this area reaching the apex and bearing prominent series of sagittate submarginal and lunulate marginal black spots which decrease in size from the tornus. The marginal lines and tails are as on the upperside.

Described from two of each sex taken recently by Captain J. Smeaton-Stuart, who has kindly presented them to the BMNH. Already in the collection were three specimens in very poor condition, one labelled '*klossii* Evans, new species', a name not published. These are all duller in colour, with the tornal areas darker, probably the result of age, but perhaps indicating a distinct subspecies in Sabah.

Luckily Captain Smeaton-Stuart remembered catching the specimens and it has been possible to label them. Halting for a rest while searching for a crashed aircraft, he saw them 'glittering like jewels against the dark green of the jungle' in a clearing on the mountain-side; 'they have an energetic flight, making frequent sorties from a favourite perch, and were fairly easy to catch' (*in litt.*).

MATERIAL EXAMINED.

Holotype ♂, EAST MALAYSIA: Sarawak, mountain due east of Serian, about 50 km S.E. of Kuching, 300 m, iv. 1966 (*Smeaton-Stuart*).

Paratypes. East Malaysia: 1 ♂, 2 ♀, Sarawak, mountain due east of Serian, about 50 km S.E. of Kuching, 300 m, iv. 1966 (*Smeaton-Stuart*).

Specimens excluded from the type-series. East Malaysia: Sabah, 2 ♂, 1 ♀, Bettotan, near Sandakan, vii–viii. 1927 (*C. B. K[loss] & H. M. P[endlebury]*).

### ***Drupadia cindi*** **sp. n.**

(Pl. 2, figs 55, 56, 59; Pl. 5, fig. 103)

In most respects this is a miniature of *D. cinderella*, but the male upperside is quite different, and male insignia are entirely lacking.

The fore wing length is 10 mm (male), 11–12 mm (female). The male upperside is very dark brown with an extensive but obscure deep purple reflection over the discs of both wings (fig. 55, but the reflection naturally does not show). The female upperside (fig. 56) is exactly as in *D. cinderella* except that the pale area on the hind wing is bluish grey instead of white. The underside (fig. 59) is marked as in *D. cinderella*, but the ground colour is slightly darker.

The holotype bears two labels, a printed one detailed below (under material examined), showing it was taken by W. B. Pryer, and a second reading; '?*Eooxylides*, ? sp. nov. ♂ [in ms.]; Named 1905 in H. H. Druce [in print]'. No such name has been published.

William Burgess Pryer left England in 1877, reaching Singapore in November, and was present at the signing of a treaty at Brunei at the end of that year. After a month negotiating a treaty with the Sultan at Sulu, which was at war with Spain, he was appointed East Coast Resident of British North Borneo and landed on 11 February 1878. Within three weeks he had both founded Sandakan (syn. Elopura), and recommenced his boyhood pursuit (and that of his younger brother, H. J. S. Pryer) collecting butterflies. He remained there for most of the next 21 years, opening up the interior and several estates (including Beatrice, Bahalla or Balhala, Byte, and Pulo Bai or Bay in Sandakan Harbour). As an invalid he revisited Sulu in 1898 and, sailing for England, died at Suez in January 1899. He was survived by his wife, Ada Pryer (Pryer, 1893; Tregonning, 1954, etc.).

MATERIAL EXAMINED.

Holotype ♂ [East Malaysia: Sabah] 'Brit. N. Borneo, probably fr. East Coast Residency. Coll. 1878–1898 by W. B. Pryer. Pres. 1900 by Mrs W. B. Pryer'. (Hope Dept. of Entomology, University Museum, Oxford.)

Paratypes. [East Malaysia: Sabah] 2 ♀, 'Brit. N. Borneo, probably fr. East Coast Residency. Coll. 1878–1898 by W. B. Pryer. Pres. 1900 by Mrs W. B. Pryer'. (Hope Dept. of Entomology, University Museum, Oxford.) Sabah; 1 ♀, Kretam, 7.vi.1950 (*J. D. H. Hedley*); 1 ♀, Silam, 31.i.1892 [*D. Cator*] '2 ditto returned to Mrs Pryer 23.i.1900'.

Note. The ♀ ex coll. Cator, from Silam (100 km due south of Sandakan) was found in the BMNH with the extra label suggesting that Cator had borrowed two others from Pryer, perhaps for comparison. If so, these would be the 2 ♀

subsequently presented, together with the unique ♂ holotype, by Mrs Pryer to the Hope collection. This strengthens the probability that these three specimens were collected in Sabah near Sandakan.

## ***Drupadia araotina*** (Evans) **comb. n.**

(Text-fig. 8; Pl. 2, figs. 41, 45)

*Horaga araotina* Evans, 1933 : 413. Holotype ♀, WEST MALAYSIA: Selangor (BMNH) [examined].

The mystery of the generic placement of this unique female will be resolved only by discovery of the male. Its tails appear to have been more ciliate than those of *Horaga* species from the same area, and the colouring of the upperside is typically *Drupadia*. It has not previously been figured.

The upperside (fig. 41) is plain dark brown with the subtornal fifth of the hind wing white crossed by dark veins. The underside (fig. 45) of the fore wing is deep ochreous, paler in the basal half and crossed obliquely by a narrow white stripe from vein 1 to the cell-end, this stripe being edged outwardly by a dark line. The hind wing basal third and apex are ochreous, the remainder white with the black markings shown in the figure; the submarginal spot in space 1 being metallic blue.

MATERIAL EXAMINED.

*Horaga araotina* Evans, holotype ♀, WEST MALAYSIA: Selangor west coast, Pulo Angsa [c. 1931] (*W. H. Evans*).

Note. The holotype bears no date but I think Brigadier Evans told me that he caught it while on leave after retiring from Army service.

## ***Drupadia abnormis*** (Moulton) **comb. n.**

(Text-fig. 4; Pl. 2, figs 48, 51)

***Biduanda*** sp. ?, ♀. Shelford, 1901 : 34, no. 37.
*Charana? abnormis* Moulton, 1911 : 156, pl. [8], fig. 10. Holotype ♀, EAST MALAYSIA: Sarawak (BMNH) [examined].
***Tajuria abnormis*** (Moulton); Seitz, 1926 : 973.

Although discovery of the male will undoubtedly require the founding of a new genus for this, Shelford's placement was probably the closest possible. Moulton moved it to *Charana*, and called it a male, on the advice of H. H. Druce, and Seitz sank *Charana* in *Tajuria*.

Through the generosity of the Sarawak Museum the holotype is now in the BMNH, and I have been able to examine the paratype. Vein 5 of the fore wing originates close to 6, and the hind wing tails are all short. The thorax and abdomen appear stout, but this may be because both specimens have in the past suffered from mould.

The colouring and pattern on both surfaces resemble those of *D. araotina* except for details on the underside evident from the figures. The hind wing upperside pale area is shot very light blue.

MATERIAL EXAMINED.

*Charana? abnormis* Moulton, holotype ♀, EAST MALAYSIA: Sarawak, Mt Penrissen [marked at figure 1], 4000 ft, v. 1899 (*R. Shelford*).

Paratype (by Moulton, *l.c.*, footnote). EAST MALAYSIA: ♀, Sarawak, Mt Kling Kang [Kelingkang, the State boundary south of Kuching], 2500 ft, x. 1911 (Sarawak Museum, Kuching, Sarawak, Malaysia).

### ***Drupadia theda*** (C. & R. Felder) **comb. n.**

(Text-fig. 3; Pl. 2, figs 50, 53; Pl. 5, fig. 104)

*Myrina theda* C. & R. Felder, 1862 : 291.

This is the second most common and widespread species after *D. ravindra*, and nearly as many subspecies have been named, although their differences are generally less spectacular. It is the only species known from Sulawesi, where it is exceptionally large and highly differentiated.

The male upperside is chalky violet-brown with a silky gloss, the terminal cilia being brown (fig. 50). The median vein and its branches in the disc of the fore wing are typically marked in red, and the hind wing black tornal spots and hairline are narrowly bordered with bluish grey. In individuals the red veining is commonly absent, while occasionally it is extended to many more veins. The female is dark brown with a subtornal pale area on the hind wing; there is an orange discal patch on the fore wing in some subspecies which changes to white or yellow in the Philippines, and becomes a subapical whitish band in Sulawesi.

The underside (fig. 53) is similar to that of *D. ravindra* with the important difference that the hind wing postdiscal spots in spaces 5 to 7 are in echelon. Although this was pointed out long ago by de Nicéville (1890*a* : 431), the distinction has been overlooked as recently as 1926 and even 1933. In *D. ravindra* (fig. 52) the spots are paired to form rough rectangles; those in spaces 6 and 7 form one, above and outside the cell-end bar, and those in spaces 4 and 5 form another, further out and parallel to the cell-end bar. This distinction similarly separates *D. rufotaenia* (fig. 65) from *D. niasica* (fig. 73), and in fact is less fallible a guide than the presence or absence of fore wing vein 9.

The Philippine subspecies are puzzling and need further investigation in the field, particularly since one is the nominotypical *D. theda theda*. The male appears to be accompanied by three forms of female; with plain, white-banded, and yellow-banded fore wing uppersides. Semper (1890 : 218) himself remarked on this, believing that they fly together and appear to be non-seasonal. He also commented on the extreme size variation in the female with a yellow or white fore wing patch, but this can now be explained. The small specimens are males or females of the hitherto overlooked subspecies of *D. niasica*.

The distinctive light brownish purple of the male upperside, similar throughout its range to that of *D. estella*, has defeated the printers of Seitz's plates, which usually show a dense dark brown.

### KEY TO SUBSPECIES OF *D. theda*

1 Large; fore wing over 20 mm (except *bangkaiensis*). Underside uniform whitish with purple-brown striations and bands; the fore wing postdiscal band oblique and directed to the tornus; the hind wing tornal metallic blue scaling extending into space 3 (Sulawesi) . . . . . . . . . . . . 13

Smaller; fore wing under 21 mm. Fore wing underside orange to ochreous grey, at least at the apex and termen, and the postdiscal band as usual parallel to the termen . . . . . . . . . . . . . . . 2

2 Fore wing underside whitish with the apical third solid dark brownish-grey; hind wing with the tornal metallic blue scaling reaching space 3 (Philippines) ***t. theda*** (Felder) (p. 330)

– Fore wing underside colour not sharply contrasted, grading from white at the base to pale or deep orange, ochreous, or grey; hind wing metallic blue scaling seldom prominent above vein 3 . . . . . . . . . . . 3

3 Fore wing underside ground colour cream to pale orange, with the apical third strongly clouded grey; hind wing white with pale brown markings reduced to basal dots and narrow discal and postdiscal dashes.

Fore wing upperside of male usually unmarked; that of female with a large orange discal patch (Burma) . . . . . . ***t. fabricii*** Moore (p. 324)

– Fore wing underside not heavily clouded, the termen evenly coloured; hind wing markings dark and bold . . . . . . . . . . . 4

4 Fore wing underside with the postdiscal band, particularly in its costal half, much darker than the ground colour, which is unusually pale . . . . . 11

– Fore wing underside with the postdiscal band dark-edged, but not itself conspicuously darker than the ground . . . . . . . . . 5

5 Fore wing underside rich deep orange in the female and at least in spaces 2 and 3 in the male, which may elsewhere be greyish brown . . . . . . 6

– Fore wing underside dull orange, yellowish, or dull greyish brown . . . 9

6 Fore wing upperside of male usually with a small dull red discal triangle; that of female with a small orange discal patch (South peninsular Thailand) ***t. renonga*** (Corbet) (p. 325)

– Fore wing upperside of male usually with at least a well-marked red discal triangle; that of female with at most a small diffuse orange discal streak . . . 7

7 Fore wing underside rich deep orange in both sexes, with the markings indistinct (Bangka Is) . . . . . . . . . . ***t. fulgens*** subsp. n. (p. 327)

– Fore wing underside greyish in the male, orange in the female; the markings distinct 8

8 Fore wing underside with the fine dark and white lines which edge the postdiscal bands well marked, so emphasizing the bands. Female hind wing upperside with the tornal half very pale whitish grey (Nias Is) ***t. demialba*** (Staudinger) (p. 326)

– Fore wing underside with the linear markings relatively diffuse. Female hind wing upperside as usual with the tornal pale bluish grey area narrow (Malaysian peninsula, E. Sumatra) . . . . . . ***t. thesmia*** (Hewitson) (p. 325)

9 Fore wing underside orange in both sexes. Female hind wing upperside with the tornal pale area normal, blue-grey and not more than 3 mm wide . . . 10

– Fore wing underside of male dull ochreous grey, that of female pale dull orange. Female hind wing upperside with the tornal area whitish and extensive (Sarawak, Sabah) . . . . . . . . . . ***t. umara*** (Fruhstorfer) (p. 328)

10 Fore wing underside dark orange; upperside with a red triangle in the male, and a small orange spot in the female (S.E. Kalimantan) . ***t. vanica*** (Fruhstorfer) (p. 328)

– Fore wing underside pale dull orange; upperside unmarked (Palawan) ***t. unicolor*** (Staudinger) (p. 329)

11 Fore wing underside ground colour uniform whitish at least to the postdiscal band. 12

– Fore wing underside ground colour pale greyish ochreous in the male, pale ochreous in the female.

As in the next two subspecies, the fore wing upperside bears red discal markings in both sexes (Pulau Telo, off central W. Sumatra) **t. batunensis** (Fruhstorfer) (p. 326)

12 Fore wing underside with orange suffusion anterior to the submarginal markings (Pagai Is) . . . . . . . . . . **t. pagiensis** (Riley) (p. 327)

– Fore wing underside uniform white to the ochreous submarginal markings (Siberut & Sipora) . . . . . . . . . **t. albicans** (Riley) (p. 327)

13 Underside evenly marked overall; the fore wing postdiscal band not emphasized.
Fore wing upperside of male unmarked or with a few very faintly red veins; that of female with a narrow, diffuse, oblique creamy postdiscal band (S. Sulawesi) **t. namusa** (Hewitson) (p. 332)

– Underside fore wing with the postdiscal band strongly coloured or completely 'filled in' . . . . . . . . . . . . . . 14

14 Larger, fore wing 20–24 mm. Upperside well marked; the male with red discal veining on fore wing and often on hind wing; the female with the band wide, up to 4 mm, and clear white (N. Sulawesi) . . **t. thaliarchus** (Staudinger) (p. 331)

– Smaller, female fore wing 17 mm. Female fore wing upperside with the band narrow and creamy, but distinct (Bangkei Is.) . **t. bangkaiensis** (Ribbe) (p. 332)

## *Drupadia theda fabricii* Moore comb. rev.

*Drupadia fabricii* Moore, 1884 : 32. Holotype ♂, BURMA (Indian Museum, Calcutta [?]).
*Biduanda fabricii* (Moore); Moore, 1886 : 42, pl. 4, figs 2, 3.
*Biduanda imitata* Druce, 1895 : 617. Holotype ♀, 'Borneo' [BURMA] (BMNH) [examined]. [Synonymized, as from Burma, by Riley, 1942 : 88.]
*Biduanda fabricii* (Moore); Seitz, 1926 : 987.
*Biduanda imitata* Druce; Seitz, 1926 : 989.
*Marmessus theda fabricii* (Moore) =*imitata* (Druce); Corbet, 1948 : 101.

Moore first described a 'female' specimen from Mergui, south Burma, which he stated was in the Indian Museum. Later (1886) he described and figured in colour both sexes from Mergui. The pair representing the subspecies in the BMNH Type Collection must be considered topotypes.

The male has the red veining on the fore wing upperside more often lacking than present, but in the female the orange band is wider than in any other subspecies, covering at least the central third of the wing.

The northern limit of the species is about 19°N., and this subspecies ranges through Thailand and lower Burma to about 11°N.

MATERIAL EXAMINED.

*Biduanda imitata* Druce, ♀ holotype, 'Borneo' [BURMA], ex coll. Rev. R. P. Murray.

BURMA: 71 ♂, 72 ♀, Karen Hills to Mergui, including topotype ♂, ♀, from Mergui; THAILAND: Phrae Dist., 2 ♂, Me Say Song, Me Lem, iv. 1918 (*E. J. Godfrey*); 1 ♀, Me Ping River, 250 ft, 5.iii.1924 (*Maj. C. H. Stockley*).

Note. 1 ♀, 'INDIA, Darjeeling' is undoubtedly a *D. theda umara*, probably from Sandakan. The labels are printed, ex colls Druce and Godman/Salvin.

### *Drupadia theda renonga* (Corbet) comb. n.

*Biduanda thesmia renonga* Corbet, 1938 : 256. Holotype ♂, THAILAND, Ranawng (BMNH) [examined].

*Marmessus theda renonga* (Corbet); Corbet, 1948 : 102.

The underside markings on this subspecies are more distinct than on the last, the veins on the disc of the fore wing upperside of the male are reddened, and the female orange band on the fore wing is restricted in width and length.

It is confined to the Kra Isthmus and Langkawi Islands, but occasional individuals occur in the extreme north of peninsular Malaysia.

MATERIAL EXAMINED.

*Biduanda thesmia renonga* Corbet, ♂ holotype, THAILAND: Ranawng (*W. Doherty*).

Paratypes. THAILAND: 10 ♂, 11 ♀ (including allotype), Ranawng (*W. Doherty*). BURMA: 7 ♂, 5 ♀, Victoria Point, xii. 1890 (*W. Doherty*).

BURMA: 3 ♂, 8 ♀, Victoria Point. THAILAND: 2 ♀, Kra Isthmus. MALAYSIA: 1 ♂, 7 ♀, Langkawi Islands, 1952–1957 (*M. J. V. Miller*); 1 ♂, 3 ♀, i. 1957, xii. 1958, ii. 1959 (*G. C. Stubbs*), in coll. Stubbs.

### *Drupadia theda thesmia* (Hewitson) comb. n.

*Myrina thesmia* Hewitson, 1863 : 32, pl. 14, figs 25–27. LECTOTYPE ♂, here designated, INDONESIA: Sumatra (BMNH) [examined].

*Biduanda thesmia* (Hewitson); Distant, 1884 : 238, figs 76, 77.

*Biduanda thesmia thesmia* (Hewitson), form *minara* Fruhstorfer, 1912 : 251. Holotype ♂, INDONESIA: Sumatra (BMNH) [examined]. [Synonymized by Riley, 1944 : 263.]

*Biduanda thesmia* (Hewitson); Seitz, 1926 : 987, pl. 159, figs f5, f6 (as '*sumatranus*'), d8.

*Biduanda minara* Fruhstorfer; Seitz, 1926 : 987, pl. 159, fig. d7 (as *thesmia*).

*Marmessus theda thesmia* (Hewitson) = *minara* (Fruhstorfer); Corbet, 1948 : 102.

This name is here used to cover specimens from the Malaysian peninsula and the whole of Sumatra. It is probable that subtle differences will be found parallel to the much greater ones of *D. ravindra* in Sumatra, but the subspecific territories and clines should be properly worked out, now that the problem is known, before naming new races.

In the BMNH Type Collection representing this taxon are a male and a female, both with plain fore wing uppersides, labelled '*thesmia*, Sumatra', ex coll. Hewitson. Of these, I now designate the male as lectotype of *Myrina thesmia* Hewitson.

Fruhstorfer introduced the name *minara* for individuals of both sexes which have fore wing upperside red or orange discal areas. Such are frequent, particularly males, throughout the range. Size, as usual, varies considerably, and some large males from different parts of Sumatra have very extensive red markings on the upperside of both wings. More usual are males with the median vein between veins 2 and 4, the basal half of vein 2, and the bases of veins 3 and 4, as well as the interspaces, all reddened, thus forming a small discal red triangle based on the anterior half of vein 2.

MATERIAL EXAMINED.

*Myrina thesmia* Hewitson, lectotype ♂, INDONESIA: Sumatra. *Biduanda thesmia thesmia*, form *minara* Fruhstorfer, holotype ♂, INDONESIA: north-east Sumatra (*Martin*).

Paralectotypes. *Myrina thesmia* Hewitson, INDONESIA: 1 ♀, Sumatra, *Biduanda thesmia thesmia*, form *minara* Fruhstorfer, INDONESIA: 1 ♀, north-east Sumatra (*Martin*).

WEST MALAYSIA: 25 ♂, 25 ♀, Malay Peninsula. SINGAPORE: 2 ♂, 3 ♀. INDONESIA: Lingga Islands, 1 ♀, ii. 1898 (*A. H. Everett*); Sumatra; north-east (Medan, Deli, Bekantshan, Sinabong), 18 ♂, 29 ♀; west (Korintji, Lebong Tandai), 2 ♂, 9 ♀; south-west (Marang), 12 ♂, 16 ♀ (*Doherty*); south-east (Palembang), 1 ♂, 2 ♀ (*Wallace*); no locality, 14 ♂, 19 ♀, 'Sumatra'.

### ***Drupadia theda demialba*** (Staudinger) **comb. n.**

[*Sithon thesmia* (Hewitson); Kheil, 1886 : 33.]
*Sithon thesmia demialba* Staudinger, 1889 : 111. Holotype ♀, INDONESIA: Nias (not located).
*Biduanda demialba* (Staudinger); Seitz, 1926 : 987, pl. 159, figs d9, e1.
[*Marmessus theda niasica* (Röber) =*demialba* (Staudinger); Corbet, 1948 : 102.]

Kheil found the species abundant on Nias. Staudinger pointed out the peculiarity of the females, which have the tornal half of the hind wing upperside almost white. His type-material, two females and a male, does not appear to be in the BMNH. The male is normal, with a red triangle on the fore wing upperside.

Both sexes in the BMNH series vary in size from 14–19 mm fore wing length.

The name *niasica* applies to the next species.

MATERIAL EXAMINED.

INDONESIA: 42 ♂, 49 ♀, Nias [11 ♀♀ are labelled 'Sumatra'].

### ***Drupadia theda batunensis*** (Fruhstorfer) **comb. n.**

*Biduanda thesmia batunensis* Fruhstorfer, 1912 : 272. 3 ♂, 2 ♀ syntypes, INDONESIA: Pulo Telo (not located).
*Biduanda batunensis* Fruhstorfer; Seitz, 1926 : 987, pl. 159, figs e2, e3.
*Marmessus theda batunensis* (Fruhstorfer); Corbet, 1948 : 102.

Fruhstorfer's type-material was three males and two females, all from Telo, the northernmost of the Batu islands. Only one Fruhstorfer specimen has been found in the BMNH, a male labelled simply 'Batu'.

As in Nias, the female has an orange patch on the fore wing upperside, but the hind wing is almost entirely dark brown. The underside in both sexes, unlike that of the next two subspecies, is well coloured.

MATERIAL EXAMINED.

INDONESIA: 2 ♂, 1 ♀, Pulo Telo, viii. 1896 (*I. Z. Kannegieter*); 2 ♀, Pulo Telo, xi. 1924 (*C. B. K[loss] & N. S[medley]*); 1 ♂, Batu (*Fruhstorfer*).

### *Drupadia theda albicans* (Riley) **comb. n.**

*Marmessus thesmia albicans* Riley, 1944 : 263, pl. 1, figs 12, 13. Holotype ♂, INDONESIA: Sipora (BMNH) [examined].
*Marmessus theda albicans* Riley; Corbet, 1948 : 102.

The whitish underside, as characterized in the key, is very distinct. On the upperside the male has a red triangle on the fore wing, and the female a very obscure orange spot.

MATERIAL EXAMINED.

*Marmessus thesmia albicans* Riley, holotype ♂, INDONESIA: Sipora, x. 1924 (*C. B. K*[*loss*] *& N. S*[*medley*]).

Paratypes. INDONESIA: Sipora; 6 ♂, ♀ allotype, 3 ♀, x. 1924 (*C. B. K. & N. S.*); Siberut, 1 ♂, 1 ♀, ix. 1924 (*C. B. K. & N. S.*); 1 ♂, 2 ♀, ix–x. 1924 (*H. H. Karny*).

### *Drupadia theda pagiensis* (Riley) **comb. n.**

*Marmessus thesmia pagiensis* Riley, 1944 : 263, pl. 1, fig. 11. Holotype ♀, INDONESIA: North Pagi Is (BMNH) [examined].
*Marmessus theda pagiensis* Riley; Corbet, 1948 : 102.

Only the female is known. The underside is characterized in the key. It is less pale than the last. The orange discal spot on the fore wing upperside is slightly larger, as well as the pale blue-grey tornal area on the hind wing.

MATERIAL EXAMINED.

*Marmessus thesmia pagiensis* Riley, holotype ♀, INDONESIA: north Pagi Island, x. 1924 (*C. B. K. & N. S.*) [Kloss & Smedley].

Paratypes. INDONESIA: North Pagi Island, 3 ♀, x. 1924 (*C. B. K. & N. S.*).

### *Drupadia theda fulgens* **subsp. n.**

(Pl. 2, figs 50, 53)

The male upperside is violet-brown, with the cilia brown except on the hind wing between the tornus and vein 4, where they are white. The fore wing disc has a red triangle based on the anterior half of vein 2, with its inner edge along the median vein and its apex at the origin of vein 4. The female upperside is plain dark brown, with the cilia as in the male, and a narrow subtornal bluish grey area on the hind wing. In both sexes there is a black tornal spot on each side of vein 2 before the white and black ante-terminal lines. The tails are black with white fringes.

The underside, which is the distinctive feature, is very rich deep orange on the fore wing and the hind wing apex in both sexes. The rather broad fore wing postdiscal band is scarcely darker than the ground colour, and is shown mainly by its pale outlines. The hind wing except the apex is whitish with the usual markings, as shown in figure 53.

The size appears to be variable and rather small, the type-series ranging evenly from 14–17 mm in males and 12–18 mm in females. All were taken at the same time.

MATERIAL EXAMINED.

Holotype ♂, INDONESIA: Bangka Island, 1891 (*Hagen*).

Paratypes. INDONESIA: 3 ♂, 7 ♀, Bangka Island, 1891 (*Hagen*).

### *Drupadia theda umara* (Fruhstorfer) **comb. n.**

*Biduanda thesmia umara* Fruhstorfer, 1912 : 251. Holotype ♀, EAST MALAYSIA: Sabah (BMNH) [examined].

*Biduanda thesmia umara*, form *depicta* Fruhstorfer, 1912 : 272. Holotype ♂, EAST MALAYSIA: Sabah (BMNH) [examined].

*Biduanda umara* Fruhstorfer; Seitz, 1926 : 987, pl. 159, fig. e4 (but not e5, which is *vanica*).

*Biduanda depicta* Fruhstorfer; Seitz, 1926 : 987.

*Marmessus theda umara* (Fruhstorfer) = *depicta* (Fruhstorfer); Corbet, 1948 : 102.

Fruhstorfer characterized this subspecies by the very white tornal fifth of the female hind wing upperside; an interesting parallel to *D. rav. surindra* and *D. ruf. kina*. The male upperside is usually unmarked, sometimes the three fore wing discal veins are faintly red, but very rarely is there a red triangle. In the complete BMNH series from Sarawak and Sabah only five males (of 60) have a distinct red triangle, and only four females (of 95) have very small, dusky, orange discal spots. The dates and localities of these appear to be random.

On the underside the male fore wing is dull ochreous grey, with the termen in spaces 1, 2, and the apex of the hind wing, brighter. The female fore wing and hind wing apex are dull brownish orange.

Fruhstorfer chose to name the more normal male, with plain upperside, as form *depicta*, so the figure by Seitz shows a red triangle.

Two possible island subspecies are noted, present material being insufficient to found new names. In the Natuna Islands the underside of the fore wing in both sexes is white, with an orange termen, an interesting parallel with the Mentawei island forms although the uppersides are plain. In Banguey [Banggi], two small females with a reduced white tornal area on the hind wing upperside have also very reduced markings on the underside, and appear to be intermediates to *D. t. unicolor* of Palawan.

MATERIAL EXAMINED.

*Biduanda thesmia umara* Fruhstorfer, holotype ♀, EAST MALAYSIA: Sabah, 'Nord Borneo (*H. Fruhstorfer*)' on label; Kina Balu in text. *Biduanda thesmia umara*, form *depicta* Fruhstorfer, holotype ♂, EAST MALAYSIA: Sabah, 'Nord Borneo (*H. Fruhstorfer*)', [Kina Balu in text].

Paratype. *Biduanda thesmia umara*, form *depicta* Fruhstorfer, BRUNEI: 1890 (*Waterstradt*), ex coll. Fruhstorfer.

EAST MALAYSIA: 60 ♂, 95 ♀, Sarawak and Sabah. Banguey [Banggi], 2 ♀, x. 1894 (*D. Cator*). INDONESIA: Natunas, Bunguran, 1 ♂, 2 ♀, ix–x. 1894 (*Everett*); 1 ♂, vii–x. 1894 ([*E.*] *Hose*)[2]; Kalimantan, south, 7 ♂, 5 ♀, Pulo Laut, vi. 1891 (*W. Doherty*).

### *Drupadia theda vanica* (Fruhstorfer) **comb. n.**

*Biduanda thesmia vanica* Fruhstorfer, 1912 : 251. Holotype ♀, INDONESIA: South Kalimantan (BMNH) [examined].

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[2] This was Ernest Hose (1872–1968), planter and zoologist in Sarawak, often confused with his cousin Edward Shaw Hose (1871–1925, son of Bishop Hose), civil servant and botanist of Malaya and Singapore. It was Ernest who collected with A. H. Everett for Lord Rothschild in the Natunas in 1894 (pers. comm., 1968).

*Biduanda vanica* Fruhstorfer; Seitz, 1926 : 987, pl. 159, fig. e5 (as '*umara*').
*Marmessus theda vanica* (Fruhstorfer); Corbet, 1948 : 102.

Fruhstorfer described this from three females. The pale area on the hind wing upperside is about half the size of that in *D. t. umara* on the holotype and one paratype, while in the third, and three other specimens, it is very narrow and blue-grey instead of white, and there is a small, dull, orange spot on the fore wing disc.

The male is quite distinct in the intense dull orange of the fore wing underside, which has no grey suffusion. The fore wing upperside of the two specimens available has a red triangle.

It is interesting that this subspecies should occupy the east coast of Kalimantan south of *D. t. umara*, but that the latter recurs further south on Pulo Laut. Specimens from central Kalimantan are needed.

MATERIAL EXAMINED.

*Biduanda thesmia vanica* Fruhstorfer, holotype ♀, INDONESIA: Kalimantan, south-east, 'S. Borneo (*H. Fruhstorfer*)' on label; Südost Borneo in text.

Paratypes. *Biduanda thesmia vanica* Fruhstorfer, INDONESIA: S.E. Kalimantan, 2 ♀, 'S. Borneo (*H. Fruhstorfer*)' [S.E. Borneo in text].

INDONESIA: S.E. Kalimantan; 1 ♂, 'S.O.B. (*Fruhstorfer*)'; 1 ♂, 1 ♀, Tameang Lajang (*Wahnes*); 1 ♀, S.E. Borneo (*Schönberg*). EAST MALAYSIA: 1 ♀, Kina Balu, Sabah.

Note. The last (Kina Balu) specimen is lightly marked below and may be an aberrant *D. t. umara* rather than an errant *D. t. vanica*.

## ***Drupadia theda unicolor*** (Staudinger) **comb. n.**

*Sithon thesmia unicolor* Staudinger, 1889 : 111. 2 ♂, 7 ♀ syntypes, PHILIPPINES: Palawan (not located).
*Biduanda thesmia unicolor* (Staudinger); Semper, 1890 : 218.
*Biduanda unicolor* (Staudinger); Seitz, 1926 : 987.
*Marmessus theda unicolor* (Staudinger); Corbet, 1948 : 102.

This is the last, the easternmost, subspecies with the fore wing underside of the conventional pattern. Staudinger described it from two males and seven females; his type-material has not been located but its features are quite clear. H. H. Druce (1895 : 613) had seen one of Staudinger's types and established his own 'type' which is now in the BMNH, from Sandakan (!) (*Pryer*).

The female upperside is plain dark brown with no trace of a pale area on the hind wing. Thus the only upperside markings are the basic ones on the extreme margin of the hind wing between the tornus and vein 4 (or 5); cilia white, a black marginal hairline, and a white line inside it. The male upperside is similar, but of the usual dull silky violet with the disca, veins faintly red. The fore wing underside is pale dull orange, slightly paler in the malel and the hind wing markings are distinctly reduced.

As usual, this Palawan subspecies appears to recur occasionally in Sabah, on the eastern coast.

MATERIAL EXAMINED.

PHILIPPINES: Palawan; 2 ♂, 2 ♀, 'Palawan'; 1 ♀, 1898 (*Doherty*). EAST MALAYSIA: Sabah, 1 ♀, Sandakan (*Pryer*).

Note. See also under *D. t. theda* below.

### ***Drupadia theda theda*** (C. & R. Felder) **comb. n.**

*Myrina theda* (Boisduval in litt.) C. & R. Felder, 1862 : 291. Type-material, PHILIPPINES: [Luzon] (BMNH) [♀ syntype examined].
[*Myrina theda* (Boisduval in litt.) Felder; Hewitson, 1863 : 32, pl. 16, figs 46, 47. Misidentification.]
*Biduanda theda* (Felder); Semper, 1890 : (5), p. 218.
*Biduanda theda* (Felder); Seitz, 1926 : 988, pl. 159, figs e6, e7, e8, f1.
*Marmessus theda theda* (Felder); Corbet, 1948 : 101–102.

The Felders' description (from the Latin) reads:

> 'Male upperside violaceous with the median branches on the fore wing coppery. Female upperside fuscous, the fore wing with an irregular white patch. Underside in both sexes white; the fore wing with two dark basal spots and with most of the outer half fuscous, marked with a short white fascia; the hind wings [are as usual].'

The female is like a large version of the male *D. niasica florens* shown at Plate 3, figures 72 (upperside), 76 (underside). Their description fits the male well, but for the female it might be modified to; '. . . the fore wings white with the apical third fuscous, and darker markings comprising a basal spot, a subbasal bar across the cell, a postdiscal band and a submarginal line'. Their 'short white fascia' is the white strip between my band and line.

The Felders introduced this name as of 'Boisd. in litt.', and said their material was supplied by Semper and Lorquin. Seven months later (April 1863), Hewitson figured an actual Boisduval specimen, no doubt originally expecting to publish it as a new name. Having been forestalled by the Felders, he referred to their description and gave none himself. But he sexes the specimen as a male, when it is quite different to the Felders' male.

Hewitson figured the upper and under sides of a small (fore wing 15 mm) very black insect with a white patch, which is indeed a male and is referable to *D. niasica* (see p. 339). The female *D. theda* is much larger and, like that of *D. niasica*, is not nearly so dark. Thus the Felders secured the name *theda* for the larger, dimorphic species, and the Philippine subspecies of the lesser one has remained undiscovered in its female series until now. As to Semper's collecting (1858–1861) in Luzon, Mindoro and Mindanao, see Felder (1861 : 297 n); and for Lorquin's almost simultaneous tour of the same area, and how his material reached both Hewitson and the Felders, see Boisduval (1869 : 8).

Unfortunately no original male *D. theda* has been found, only a female syntype. A lectotype is not here designated in the hope that a male may yet be found.

So much for the application of the name. Another problem now arises. There are two further forms of the female; one with a yellow patch and one with none at all, the latter like *D. t. unicolor*. Semper himself remarked that the female patch varied from white to yellow irrespective of locality and season (noting also some very small 'females'!), and further work in the field is necessary.

MATERIAL EXAMINED.

*Myrina theda* Felder, syntype ♀, PHILIPPINES: [Luzon] (labelled only 'nov. gen. *theda* ♀: Philipp.').

PHILIPPINES: 3 ♂, 5 ♀ (no further locality. Includes ♀ ex coll. Boisduval labelled '*theda* Boisd.'); 1 ♂, 1 ♀, Luzon; 1 ♀, Mindoro; 1 ♀, 'Mind.'; 1 ♂, 1 ♀, 'Sumatra' [?Semerara]; 1 ♀, Cebu; 2 ♂, 5 ♀, Mindanao, Davao (*Platen*); 7 ♂, 44 ♀, S.E. Mindanao, Lanao plain, Kolambugan, v–vi. 1914 (*A. E. Wileman*).

Note. The females listed are all white-patched except one from 'Philippines' and the one from Cebu which are creamy; and all those from S.E. Mindanao of which 35 are yellow and 9 are *unicolor*. Some fading may be involved here.

### ***Drupadia theda thaliarchus*** (Staudinger) **comb. n.**

*Sithon thaliarchus* Staudinger, 1888 : 277, pl. 95. Syntypes ♂, ♀, INDONESIA: Sulawesi north, Minahassa (not located).
*Biduanda thaliarchus* (Staudinger); Fruhstorfer, 1912 : 252.
*Biduanda inexpectata* Ribbe, 1926 : 78. Holotype ♂, INDONESIA: Sulawesi central, Watumodje (not located). **Syn. n.**
*Biduanda thaliarchus* (Staudinger); Seitz, 1926 : 988, pl. 146B, fig. e1.
*Marmessus theda thaliarchus* (Staudinger); Corbet, 1948 : 102.

This is the largest subspecies in the genus. Its features have been given in the key.

None of Staudinger's type-series of both sexes from Minahassa, collected by Dr Platen, has been located. Nor has the unique male described by Ribbe, collected by Dr Martin.

Staudinger stated that the peculiar obscure blue spots shown in his otherwise good figure were lacking on his other specimens. Such blemishes occur at random on occasional male *D. theda* specimens and appear to be due to wetting or splash from some chemical. Unfortunately Seitz reproduced those spots prominently, without comment. They should be disregarded. Staudinger also remarked that the size varied greatly, and he had one male little larger than [*Rathinda*] *amor* [fore wing 15 mm). One wonders whether his series included *D. niasica* again or, since he identified the male, perhaps *D. estella*. He did not give any upper size limit but his figured male has a fore wing of 24 mm. The BMNH series has fore wings 20–24 mm.

Ribbe introduced *D. inexpectata* for one male from Watumodje [about 2°N.120°E.], comparing it in great detail with *D. t. namusa*. It appears to differ from *D. t. thaliarchus* only in having a red triangle on the fore wing upperside. He did not state its size.

MATERIAL EXAMINED.

INDONESIA: 4 ♂, 2 ♀, North Sulawesi, Minahassa; 1 ♂, 'Celebes' [*Wallace*]; 1 ♀, 'Amboine' (ex coll. Ed. Brabant).

### ***Drupadia theda namusa*** (Hewitson) **comb. n.**

*Myrina namusa* Hewitson, 1863 : 33, no. 19, pl. 13, figs 23, 24. Type-material ♀, INDONESIA: South Sulawesi, Macassar (not located).
*Myrina naenia* Hewitson, 1863 : 33, no. 20, pl. 13, figs 21, 22. Holotype ♂, INDONESIA: 'Celebes' [South Sulawesi] (BMNH) [examined].
*Biduanda namusa* (Hewitson); Seitz, 1926 : 988, pl. 146B, figs e2, e3.
*Biduanda naenia* (Hewitson); Seitz, 1926 : 988, pl. 146B, figs d6, d7.
*Marmessus theda namusa* (Hewitson) =*naenia* (Hewitson); Corbet, 1948 : 102.

Hewitson described the female (*namusa*) and the male as distinct because of slight individual variation in the depth of shading in some of the underside markings. The two names appear never to have been synonymized until Corbet, as first reviser, gave priority to the name *namusa*. Unfortunately the only surviving type-specimen is that of *naenia*.

This subspecies from southern Sulawesi is slightly smaller than *D. t. thaliarchus* (fore wing 18–21 mm); the female upperside whitish band is very narrow and diffuse, and the underside markings paler.

One male in the BMNH has the written entry '*naenia*. Makian' on its printed 'coll. Hewitson' label. Makian is a small island in the Halmahera group opposite to Minahassa, surprisingly far from Macassar. Underneath the label is gummed a smaller one, like so many of Wallace's ones, with the entry 'Mak'. This could be an error for Macassar, but Wallace did collect 'a few interesting insects' on the east coast of Makian, on 12 October 1858.

MATERIAL EXAMINED.

*Myrina naenia* Hewitson, holotype ♂, INDONESIA: [South] Sulawesi.

INDONESIA: 3 ♂, Sulawesi [south] (*Wallace*); 1 ♂, 'Makian' [? Macassar] (ex coll. Hewitson); 1 ♀, Macassar (ex coll. Hewitson); 7 ♂, 14 ♀, S. Sulawesi, viii–ix. 1891 (*W. Doherty*); 1 ♂, 7 ♀, S. Sulawesi, Pic de Bonthain, 1000–2000 m, 1896 (*W. Doherty*); 4 ♀, Macassar, 1896 (*W. Doherty*); 2 ♀, 'Celebes', x. 1923 (*C. J. Brooks*).

### ***Drupadia theda bangkaiensis*** (Ribbe) **comb. n.**

[*Biduanda namusa* (Hewitson); Fruhstorfer, 1912 : 252, Toli Toli, N.W. Sulawesi. Misidentification.]
*Biduanda bangkaiensis* Ribbe, 1926 : 80. Holotype ♀, INDONESIA: Bangkai [Banggai] Island (not located).

This is an unsatisfactory taxon. Ribbe described only the female, comparing it briefly with *D. t. namusa* without mentioning *Biduanda inexpectata* to which he had just devoted a whole page, and giving no indication of its size.

If interpreted correctly, his description covers three 'unattached' females in the BMNH from scattered localities, as listed below. All are small, with fore wing 16–17 mm.

Fruhstorfer said he did not know *Biduanda naenia* and had found in his short visits to Sulawesi only one specimen of what he called *B. namusa*, at the north-western extreme of Sulawesi. This specimen is in the BMNH and is certainly neither, being too small.

Pending discovery of males, this seems to be the most suitable position for Ribbe's name, and the only possible identification at present for these three specimens, one of which is from the type-locality.

MATERIAL EXAMINED.

INDONESIA: 1 ♀ [fore wing 17 mm], Bangkei [Banggai], 1885 (*H. Kühn*); 1 ♀ [fore wing 17 mm], Sulawesi, N.E., Minahassa; 1 ♀ [fore wing 16 mm], Sulawesi, N.W., Toli Toli, xi–xii. 1895 (*H. Fruhstorfer*).

### ***Drupadia niasica*** (Röber) **comb. n.**

(Pl. 3, figs 69–76; Pl. 5, fig. 105)

*Sithon niasica* Röber, 1886 : 68, pl. 5, fig. 20.

This name, introduced with a good description and figure, was for long obscured by repeated errors and now, rather embarrassingly, covers a species ranging from Burma through Kalimantan to the Philippines. Within three years of Röber's publication, Staudinger created a primary homonym, which he corrected to *Sithon niasicola*, but that insect had already been named *D. caesarea* by Weymer. Fruhstorfer (1912 : 249) placed Röber's insect between Weymer's and his own *D. rufotaenia*, saying wrongly that the underside was like *D. ravindra moorei*. Seitz explained Staudinger's nomenclature errors correctly and figured the correct *D. caesarea* female, but figured the brilliant male as *niasica* Röber. Finally, the name was misapplied to a subspecies of *D. theda* (see Cowan, 1965).

This species bears exactly the same relationship to *D. theda* as does *D. rufotaenia* to *D. ravindra*. Its underside markings are identical to those of *D. theda*, it is smaller, lacks male insignia and is not strongly sexually dimorphic, it seems to cover the same range, and its geographic variation approximates to that of the female *D. theda*.

The size is about two-thirds that of *D. theda*. The upperside is dark brown, more intense and sometimes with a faint transparent violet wash in the male, and often with an orange, yellow or white fore wing discal patch.

KEY TO SUBSPECIES OF *D. niasica*

1 Fore wing underside uniform dark purple-brown in the apical third, from end cell to near tornus; the remainder and hind wing underside uniform whitish or cream, with dark brown markings . . . . . . . . . . . . . 9

– Fore wing underside not with two strongly contrasted ground colours . . . . 2

2 Fore wing underside ground colour shading from whitish dorsally to pale yellow, with the apical quarter lightly suffused with transparent grey . . . . . 3

– Fore wing underside white to orange or dark brown . . . . . . . . 4

3 Fore wing upperside with a large discal patch; diffuse, ovate, and whitish to dull orange in the male; clear, oblique, and bright orange in the female. Hind wing

upperside with a pale grey area; discal and of variable extent in the male, filling at least the basal halves of spaces 3 to 5; subtornal and restricted in the female (Burma) . . . . . . . . ***n. scudderii*** (Doherty) (p. 334)
– Upperside of male as usual dark brown with a violet wash, and with small, diffuse pale discal areas; orange on fore wing and grey on hind wing, each with a dark dot at the cell end (Langkawi Is) . . . . . ***n. biranta*** (Riley) (p. 335)
4 Fore wing underside bright or dark orange.
Upperside unmarked except for the narrow tornal grey area on the female hind wing (West Malaysia) . . . . . . ***n. perlisa*** (Riley) (p. 335)
– Fore wing underside not bright or dark orange . . . . . . . . 5
5 Upperside unmarked, but the hind wing tornal third very pale grey in both sexes.
Fore wing underside dull grey-brown (Nias Is) . ***n. niasica*** (Röber) (p. 335)
– Hind wing upperside without a wide pale tornal area . . . . . . 6
6 Fore wing upperside with an orange patch in the bases of spaces 2 and 3.
Fore wing underside dull orange-brown (Pulo Telo, Batu Is.)
***n. ianthina*** subsp. n. (p. 336)
– Fore wing upperside with at most an orange dot against the origin of vein 3 . . 7
7 Fore wing underside mainly white, only the termen greyish brown (Siberut & Sipora Is.) . . . . . . . . . . . . . ***n. karnyi*** (p. 336)
– Fore wing underside well coloured as usual.
Upperside uniform dark brown with a narrow grey tornal area on the hind wing; the male obscurely shot with violet except for distinct marginal borders . 8
8 Fore wing underside of male uniform dull grey-brown; that of female dull orange (S.W. Sumatra) . . . . . . . . . . ***n. dohertyi*** (Riley) (p. 336)
– Fore wing underside shading from whitish at base to dark orange-brown in male, dull yellow-brown in female (Pulo Laut, S. Kalimantan) . ***n. ultra*** subsp. n. (p. 337)
9 Upperside dark brown, the fore wing with a large white discal patch (N. Philippines)
***n. thaenia*** (Druce) (p. 337)
– Fore wing upperside with the discal patch yellow (S. Philippines)
***n. florens*** subsp. n. (p. 338)

## ***Drupadia niasica scudderii*** (Doherty) **comb. n.**

*Biduanda scudderii* Doherty, 1889*b* : 426, pl. 23, fig. 14. Holotype ♂, SOUTH BURMA (not located).
*Biduanda scudderii* Doherty; Nicéville, 1890*a* : 427.
*Biduanda scudderi* Doherty; Seitz, 1926 : 988.
*Marmessus scudderii scudderii* (Doherty); Riley, 1942 : 88.
*Marmessus niasicus scudderii* (Doherty); Cowan, 1965 : 167.

The upperside is dark brown; the fore wing with a yellow discal patch in the male and a slightly larger orange one in the female; the hind wing with a greyish subtornal pale area. In the male the wings are overlaid with an obscure transparent violet wash. The underside is marked exactly as that of *D. theda fabricii*, the fore wing ground colour being pale dull orange. The fore wing length is 11–13 mm.

Doherty did not say where the holotype was placed. There was only one specimen, a male taken at Mergui, i–iii. 1889, 'at the height of the dry season' (Doherty, 1889 *b* : 409). De Nicéville said he had seen it, which suggests that it was not lodged at Calcutta. Possibly, with specimens described earlier that year, it was sent to B. Neumoegen (Doherty, 1889 *a* : 123), and subsequently passed to the U.S. National Museum or the Carnegie Museum (Cowan, 1966 *b* : 418).

MATERIAL EXAMINED.

SOUTH BURMA: 6 ♂, 1 ♀ (Ataran, Kanbauk, Dawna Hills); 2 ♂, 1 ♀, Tavoy; 7 ♂, 2 ♀, Mergui; 2 ♂, 2 ♀, Victoria Point; 1 ♂, 'Birmanie'.

### ***Drupadia niasica biranta*** (Riley) **comb. n.**

*Marmessus scudderii biranta* Riley, 1942 : 88. Holotype ♂, WEST MALAYSIA: Langkawi Is. (BMNH) [examined].
*Marmessus scudderii biranta* Riley, 1944 : 265, pl. 1, fig. 16, pl. 2, fig. 29.
*Marmessus niasicus biranta* Riley; Cowan, 1965 : 167.

The orange patch on the fore wing of this subspecies is diffuse and smaller than in the last, and the upperside and underside are appreciably darker. The fore wing length is 13–14 mm.

MATERIAL EXAMINED.

*Marmessus scudderii biranta* Riley, holotype ♂, WEST MALAYSIA: Langkawi Islands, 15.i.1939 (*J. N. Eliot*).

WEST MALAYSIA: Langkawi Islands, 1 ♂, 25.ii.1960 (*G. C. Stubbs*) (in coll. Stubbs).

### ***Drupadia niasica perlisa*** (Riley) **comb. n.**

*Marmessus scudderii perlisa* Riley, 1942 : 88. Holotype ♂, WEST MALAYSIA: Perlis (BMNH) [examined].
*Marmessus scudderii perlisa* Riley; Riley, 1944 : 265, pl. 1, fig. 17, pl. 2, fig. 28.
*Marmessus scudderii perlisa* Riley; Eliot, 1959 : 382.
*Marmessus niasicus perlisus* Riley; Cowan, 1965 : 167.

This subspecies is very much darker than the last both above and below, and there is at most a faint trace only of the fore wing discal patch on the upperside. The fore wing length is 12–14 mm.

The type-locality is on the northern boundary of Malaysia, but the name can be applied to specimens from Perlis southwards, probably to Singapore.

MATERIAL EXAMINED.

*Marmessus scudderii perlisa* Riley, holotype ♂, WEST MALAYSIA: Perlis, Kaki Bukit, 200 ft, 8.i.1939 (*C. F. Cowan*).

WEST MALAYSIA: 1 ♀, Perlis, Kaki Bukit, 20.xi.1953 (*C. F. Cowan*); 1 ♀, Negeri Sembilan, Pantai Waterworks (on clipped *Hybiscus*), 5.ix.1958 (*H. L. Lewis*); 1 ♂, Selangor, 16 miles from Kuala Lumpur, Pahang Road, 13.iv.1956 (*J. A. Hislop*) (in coll. Hislop).

### ***Drupadia niasica niasica*** (Röber) **comb. n.**

(Pl. 3, figs 69, 73)

*Sithon niasica* Röber, 1886 : 68, pl. 5, fig. 20. Holotype ♂, INDONESIA: Nias Is. (not located).
*Marmessus niasica* (Röber); Fruhstorfer, 1912 : 249.
*Marmessus niasicus niasicus* (Röber); Cowan, 1965 : 167.

The error which resulted in Seitz (1926, pl. 159, fig. 16) misapplying this name to the *D. ravindra caesarea* male has already been noted. Röber's description and figure are good.

The upperside is plain dark brown with the subtornal third of the hind wing pale greyish white. The male is obscurely washed violet. On the underside the markings are as in *D. theda demialba*, and the fore wing ground colour is greyish brown. Fruhstorfer said that the hind wing markings were like those of *D. ravindra moorei*, which is incorrect. The fore wing length is 14 mm (Röber gave the expanse as 23 mm).

MATERIAL EXAMINED.

INDONESIA: 1 ♂, Nias; 1 ♀, 'Sumatra'.

### ***Drupadia niasica ianthina*** **subsp. n.**

(Pl. 3, figs 70, 74)

On the upperside this subspecies is reminiscent of the Burmese *D. n. scudderii*. Both sexes are dark brown with a rather small but well defined orange discal patch on the fore wing, and the subtornal third of the female hind wing is pale greyish white. The male is violet washed as usual. On the underside the fore wing ground colour is orange-brown, and the dark brown markings are normal (fig. 74). The fore wing length is 14 mm.

MATERIAL EXAMINED.

Holotype ♂, INDONESIA: Pulo Telo (Batu Is), viii. 1896 (*I. Z. Kannegieter*).

Paratype. 1 ♀, INDONESIA: Pulo Telo, xi. 1924 (*C. B. K. & N. S.*) [Kloss & Smedley].

### ***Drupadia niasica karnyi*** (Riley) **comb. n.**

*Marmessus scudderii karnyi* Riley, 1944 : 264, pl. 1, figs 1, 20. Holotype ♂, INDONESIA: Siberut (BMNH) [examined].
*Marmessus niasicus karnyi* Riley; Cowan, 1965 : 167.

The fore wing upperside is plain, or with a small and very diffuse orange spot, and the hind wing subtornal pale area is likewise diffuse and restricted. The underside is distinctive in that the fore wing ground colour is mostly whitish, as in *D. theda albicans*. Some of the female paratypes are quite large (up to 16 mm fore wing length), and it is difficult to say with confidence that they are not the latter species. Male fore wing length 13–14 mm.

MATERIAL EXAMINED.

*Marmessus scudderii karnyi* Riley, holotype ♂, INDONESIA: Siberut, 30.ix.1924 (*H. H. Karny*).

Paratypes. INDONESIA: 3 ♀, Siberut, ix. 1924 (*C. B. K[loss] & N. S[medley]*); 1 ♂, 2 ♀, Sipora, x. 1924 (*C. B. K. & N. S.*); 2 ♀, Sipora, x–xi. 1924 (*H. H. Karny*); 1 ♂, N. Pagi Is, x. 1924 (*C. B. K. & N. S.*).

### ***Drupadia niasica dohertyi*** (Riley) **comb. n.**

*Marmessus scudderii dohertyi* Riley, 1944 : 264, pl. 1, figs 18, 19. Holotype ♂, INDONESIA: S.W. Sumatra (BMNH) [examined].
*Marmessus niasicus dohertyi* Riley; Cowan, 1965 : 167.

The fore wing upperside orange spot is faint or absent, and the restricted pale area on the hind wing is distinctly tinted blue. The ground colour of the fore wing is greyish brown in the male, and brownish orange in the female.

These appear to be the only specimens of *D. niasica* so far recorded from the main island of Sumatra.

MATERIAL EXAMINED.

*Marmessus scudderii dohertyi* Riley, holotype ♂, INDONESIA: S.W. Sumatra, Marang, 1890 (*W. Doherty*).

Paratypes. INDONESIA: ♀ allotype, 2 ♂, 2 ♀, S.W. Sumatra, Marang, 1890 (*W. Doherty*).

INDONESIA: 1 ♂, W. Sumatra (ex coll. Fruhstorfer, with his type label but no other data).

### ***Drupadia niasica ultra*** **subsp. n.**

(Pl. 3, figs 71, 75)

This subspecies is very dark brown on the upperside, unmarked except for some sparse grey scales near the hind wing tornus. It is the only subspecies so far described whose male has no discernible violet wash on the upperside, a feature which becomes obsolete from Borneo eastwards. The underside is boldly marked with dark brown in the usual pattern (fig. 75), the ground colour of the fore wing being whitish at the dorsum shading to brown anteriorly. The fore wing length is 12–13 mm for the two males of the type-series.

Included under this name until fuller material becomes available are six further specimens from scattered localities in Sarawak and Sabah which probably represent one or more larger subspecies, with a more extensive and sometimes bluish subtornal pale area on the hind wing upperside, and a darker fore wing underside. These are not included as paratypes. In connection with the first listed and least divergent, from 'Borneo', it is noted that F. D. Godman, its acquisitor, and H. J. Elwes, were brothers-in-law and had frequent correspondence.

MATERIAL EXAMINED.

Holotype ♂, INDONESIA: South Kalimantan; Pulo Laut, vi. 1891 (*W. Doherty*) (ex coll. H. J. Elwes).

Paratype. 1 ♂, INDONESIA: South Kalimantan; Pulo Laut, vi. 1891 (*W. Doherty*) (ex coll. H. J. Elwes).

Specimens excluded from the type-series. INDONESIA [?]: 1 ♂, 'Borneo' (ex coll. Godman & Salvin). EAST MALAYSIA: Sarawak, 1 ♂ (*Native collector*) [no other data]; Sabah; 1 ♂, Meleman, 5.ix.1919; 1 ♀, Bahalla Is [Sandakan], 14.v.1894 (*D. Cator*); 1 ♀, Sandakan, 9.ix.1894 (*D. Cator*); 1 ♂, Quoin, 8.xi.1961 (*T. Norman*) (in coll. Norman).

### ***Drupadia niasica thaenia*** (Druce) **comb. n.**

*Biduanda thaenia* Druce, 1895 : 614, pl. 34, fig. 2. Holotype ♀, EAST MALAYSIA: Sabah [? WEST PHILIPPINES] (BMNH) [examined].

*Biduanda thaenia* Druce; Seitz, 1926 : 988, pl. 147, fig. c5 (as '*taenia*').
*Marmessus theda thaenia* (Druce); Corbet, 1948 : 102.

The unique female is dull brown on the upperside, with a large diffuse white fore wing patch. The underside is white with the fore wing apex shaded pale brown, and the usual markings are faintly indicated in darker brown. The fore wing length is 15 mm.

Seitz copied Druce's figure, but it is reproduced in intense black and white. If this is allowed for, it gives an excellent impression of the insect. His text however is most misleading, saying that the hind wing upperside has a violet reflection and the underside resembles *D. scaeva*.

Corbet very reasonably placed this as a subspecies of *D. theda*, but that was before it was realized that *D. niasica* flies in the Philippines, where it resembles a small *D. theda* female. The present specimen is just like a small white-banded *D. theda* female on the upperside, and is intermediate between it and Bornean *D. niasica* on the underside. Recalling that Palawan and Sulu subspecies of other species are occasionally found as individuals in east Sabah, it seems most likely that this specimen represents a western Philippine subspecies of *D. niasica*. It might even have been taken there by Pryer during his early travels, and mislabelled.

Support for this view is afforded by a specimen found among a series of white-banded *D. theda* females. It is small (fore wing length 14 mm) and, despite its age, is nearly black instead of brown on the upperside. It lacks abdomen and legs but its appearance strongly suggests that it is a male. It formerly belonged to Boisduval (who originally proposed the ms. name *theda*), and its only other label is 'Jalajala'. The only place of this name traceable was on the east coast of the eastern of two peninsulas on the north shore of Laguna de Bay, south-east of Manila, Luzon (nearly opposite the town of Santa Cruz). It is marked only on old maps and may have been a plantation. It sometimes appears as Halahala. The underside of this presumed male is, as one would expect, heavily marked like the Luzon *D. theda*, and both surfaces resemble the *D. niasica florens* male (figs 72, 76) although that has a yellow patch.

Until further material of *D. niasica* from intervening areas becomes available, these two specimens are assumed to represent a N.W. Philippine subspecies of it.

MATERIAL EXAMINED.

*Biduanda thaenia* Druce, ♀ holotype, EAST MALAYSIA: Sabah [? WEST PHILIPPINES], 'Sandakan' (*Pryer*) (ex coll. Godman & Salvin).

[PHILIPPINES: Luzon,] 1 ♂ [?], Jalajala [50 km S.E. of Manila] (ex coll. Boisduval, *via* coll. Oberthür).

### ***Drupadia niasica florens*** **subsp. n.**

(Pl. 3, figs 72, 76)

[*Myrina theda* (Boisduval in litt.) Felder; Hewitson, 1863 : 32, pl. 16, figs 46, 47. Misidentification.]

The upperside is very dark brown with an oblique bright yellow patch on the central third of the fore wing, from near mid-costa to near tornus (fig. 72), and with the usual two black tornal spots on the hind wing crowned with obscure grey lunules. The underside (fig. 76) is creamy white with the usual dark brown markings, and the apical third of the fore wing dark chocolate-brown. The female upperside is slightly paler than that of the male but the fore wing patch is brighter. The fore wing length is 13–17 mm (male 13–15 mm).

The type-series was found among the fine collection of *D. theda* females made in Mindanao by Wileman. It is hoped that further examples, both white and yellow patched, may now be found from this and other islands. The possibility of *D. niasica* occurring in Sulawesi is suggested, and it is even possible that *Biduanda bangkaiensis* Ribbe (see under *D. theda*) may be a subspecies of it.

Hewitson's figure of a Boisduval specimen labelled *theda* has already been mentioned (p. 330). It closely resembles *florens* but has a white patch like the 'Jalajala' specimen of *thaenia*. Hewitson sexed it as male. It certainly is not a male *theda*, but could well be a male *niasica*. It came from Mindanao, so may be placed as a white form of *florens* pending further material.

MATERIAL EXAMINED.

Holotype ♂, PHILIPPINES: Mindanao, Kolambugan, Lanao Plains, 12.vi.1914 (*A. E. Wileman*).

Paratypes. PHILIPPINES: Mindanao, 12 ♂, 8 ♀, Kolambugan, Lanao Plains, 19.v.–19.vi.1914 (*A. E. Wileman*).

## ***Drupadia estella*** (Hewitson) **comb. n.**

(Pl. 2, figs 57, 60; Pl. 6, fig. 106)

***Myrina estella*** Hewitson, 1863 : 31, pl. 16, figs 50, 51.

The upperside is nearest to *D. theda*, but is less variable geographically. The chalky-purple male is of the same hue but never has red veining and always has a narrow (1 mm) dark brown terminal border to both wings (fig. 57). The female is dark brown with a bluish or greyish white subtornal area on the hind wing and, in Burma, a diffuse orange patch on the fore wing.

The underside (fig. 60) is distinctive, with chocolate-brown markings on white, except in Burma where it closely approaches the appearance of *D. scaeva melisa* (fig. 82). There is considerable size variation in Malaysia and Indonesia, but material is insufficient to analyse its nature.

Always rare, the known range of the species is only from Burma south of 18° North to Sumatra, south Kalimantan and Sabah. Males greatly preponderate in collections from the continent, and females from the islands.

### KEY TO SUBSPECIES OF *D. estella*

1 Underside with all markings reduced to small dots and dashes. Female fore wing upperside with a distinct orange patch (Burma) . ***e. nicevillei*** (Doherty) (p. 340)

– Underside with the markings bold, in dark red-brown or black. Female fore wing upperside plain dark brown, or at most with a discal reddish flush . . . 2

2 Fore wing underside with the termen bright orange, at least to vein 4 (West Malaysia) ***e. semperna*** (Corbet) (p. 340)

– Fore wing underside with the termen dull reddish brown (Sumatra, Kalimantan, Sabah) . . . . . . . . . . . ***e. estella*** (Hewitson) (p. 340)

### ***Drupadia estella nicevillei*** (Doherty) **comb. n.**

*Biduanda nicevillei* Doherty, 1889 : 426, pl. 23, fig. 16. 2 ♂ syntypes, Burma (not located).
*Biduanda nicevillei* Doherty; Nicéville, 1890 *a* : 428.
*Biduanda nicevillei* Doherty; Evans, 1921 : [38], no. 37f.
*Biduanda nicevillei* Doherty; Seitz, 1926 : 988.
*Marmessus estella nicevillei* (Doherty); Corbet, 1944 : 40.

Doherty described two males of the unmistakeable insect now well known from Myitta, near Tavoy, south Burma (not to be confused with Myittha, north of Meiktila on the road to Mandalay). They were purple, but that colour defeated the printers who made it nearly black, as did Seitz. His syntypes are probably with that of *B. scudderii* (see *D. niasica scudderii* above).

The female was not found for over 30 years and even then its identity was debated. Evens (1921) diagnosed it correctly but in the same issue of the *Journal*, Ollenbach confused it with the very similar *D. scaeva melisa* (q.v.).

MATERIAL EXAMINED.

BURMA: south, 12 ♂, 1 ♀, Kanbauk, Pagaiye, Tavoy, etc.

### ***Drupadia estella semperna*** (Corbet) **comb. n.**

(Pl. 2, figs 57, 60)

*Marmessus estella semperna* Corbet, 1944 : 40. Holotype ♂, West Malaysia (BMNH) [examined].

Described under the species heading and in the key, this subspecies is larger than that in Burma, the fore wing length being 15–16 mm, as opposed to 13–15 mm. The holotype, like some other hill specimens, is exceptionally large at 17 mm (Corbet's 14·5 mm must be an error).

This subspecies is very poorly represented in the BMNH.

MATERIAL EXAMINED.

*Marmessus estella semperna* Corbet, holotype ♂, WEST MALAYSIA: Frasers Hill, 4000 ft, 2.vi.1938 (*J. N. Eliot*).

WEST MALAYSIA: 2 ♂, Perak, Maxwell's Hill, 13–14.vi.1953 (*C. F. Cowan*); 1 ♀. Langkawi Is, 15.i.1939 (*J. N. Eliot*) (in coll. Eliot).

### ***Drupadia estella estella*** (Hewitson) **comb. n.**

*Myrina estella* Hewitson, 1863 : 31, pl. 16, figs 50, 51. LECTOTYPE ♂, here designated, INDONESIA: Sumatra (BMNH) [examined].

***Sithon estella*** (Hewitson); Snellen, 1890 : 299.
***Biduanda estella*** (Hewitson); Nicéville & Martin, 1896 : 480, no. 483.
[***Biduanda nicevillei*** Doherty; Nicéville & Martin, 1896 : 480, no. 485.]
***Marmessus estella*** (Hewitson); Seitz, 1926 : 990, pl. 159, figs f9, f10.

Hewitson described both sexes and figured the male. His syntypes are in the BMNH. I now designate the male as lectotype of *Myrina estella* Hewitson.

Snellen recorded a female from Billiton [Belitoeng]. De Nicéville & Martin, saying they had not found *B. estella* in Sumatra, went on to describe specimens in error as 'the hitherto unknown female of *B. nicevillei*'.

As already noted, Seitz's figure of the male should be purple, not black. His figure of the female is very large (fore wing 18 mm), and the tornal half of the hind wing is white, corresponding to two females ex coll. Martin from the Battack Mountains. There may be a good subspecies near Sibolga of which these are outlying examples. High altitude specimens are often large, and there are some females nearly as big from Kina Balu which otherwise do not differ from the normal.

MATERIAL EXAMINED.

*Myrina estella* Hewitson, lectotype ♂, INDONESIA: Sumatra (ex coll. Hewitson).

Paralectotype. 1 ♀, INDONESIA: Sumatra (ex coll. Hewitson).

INDONESIA: 7 ♂, 5 ♀, Sumatra (ex colls Hewitson, Wallace, and Felder); 2 ♀, N.E. Sumatra, Battack Mountains, xii. 1892, i. 1895 (*Martin*); Kalimantan, 1 ♂, 4 ♀, Pulo Laut, vi. 1891 (*W. Doherty*). EAST MALAYSIA: Sabah, 9 ♀, Kina Balu (*Waterstradt*); 1 ♀, Kina Balu (ex coll. Fruhstorfer, labelled 'Type' and 'f. *depicta* Fruhst.', which can only be an error).

### **Drupadia scaeva** (Hewitson) **comb. n.**

(Text-fig. 7; Pl. 3, figs 77–84; Pl. 6, fig. 107)

***Myrina scaeva*** Hewitson, 1863 : 30, pl. 15, figs 39, 40.

This is the only member of the genus found north of Burma. Its four subspecies are markedly diverse, and that from Sikkim is comparatively large. It appears to be rare throughout its range except in South Burma, where both sexes have been obtained in plenty.

In the male the fore wing dorsum is slightly lobed in the basal half, the lobe overlapping an obscure oval brand in the base of space 7 and a bright orange streak which runs along the costa of the hind wing. This streak becomes whitish in *D. s. scaeva*. The occurrence of dwarf males is discussed under *D. s. scaeva*.

KEY TO SUBSPECIES OF *D. scaeva*

1 Larger, fore wing length at least 15 mm. Underside finely etched with curved lines and minutely mottled in black on very pale grey. Female fore wing upperside with a broad L-shaped orange patch covering the end of the cell and the bases of spaces 2 and 3, bisected by the black disco-cellular vein and vein 3 . . 2

– Smaller, fore wing not over 15 mm. Underside, particularly of fore wing, more solidly marked, in brown on white. Female fore wing upperside normally unmarked . . . . . . . . . . . . . 3

2 Male fore wing upperside with a clear white discal patch; the hind wing upperside tornal half dull greyish blue (Sikkim, Bhutan) . . . **s. cyara** (Hewitson) (p. 342)

– Male fore wing upperside plain black; hind wing shining deep violet (N. Burma; N. Thailand) . . . . . . . . . **s. cooperi** (Tytler) (p. 343)

3 Male fore wing upperside plain black; hind wing tornal half shining deep blue (S. Burma) . . . . . . . . **s. melisa** (Hewitson) (p. 343)

– Male fore wing upperside with a shining light blue patch (absent in dwarfs) filling the bases of spaces 2 and 3 and bisected by the black vein 3; hind wing with the tornal half a matching light blue (Peninsular Malaysia; Sumatra; Borneo/Kalimantan) **s. scaeva** (Hewitson) (p. 344)

### ***Drupadia scaeva cyara*** (Hewitson) **comb. n.**

(Pl. 3, figs 77, 81)

[*Myrina melisa* '♀' Hewitson, 1869 : Suppl. p. 6, Suppl. pl. 3, figs 82, 83. Misidentification.]
*Myrina cyara* Hewitson, 1878 : Suppl. p. 26, Suppl. pl. 3b, figs 109, 110. Holotype ♀, INDIA: Darjeeling (BMNH) [examined].
*Biduanda cyara* (Hewitson); Nicéville, 1890*a* : 427.
*Biduanda cyara* (Hewitson); Riley & Godfrey, 1921 : 187.
*Biduanda cyara* (Hewitson); Seitz, 1926 : 988, pl. 146B, figs d2, d3 (as *melisa*), d4, d5.
*Biduanda melisa cyara* (Hewitson); Evans, 1925 : 766.
*Marmessus scaeva cyara* (Hewitson); Cantlie, 1963 : 135.

Hewitson described as the two sexes of *Myrina melisa* a male from south Burma and a 'female' from Darjeeling, north India, figuring the latter. He later described as *Myrina cyara* a specimen from Darjeeling, sex not stated but in fact a female, which pairs with the 'female' *melisa*. While *melisa* was used for the more familiar insect, the uncertainty over the name for the rare northern one persisted long enough to mislead Seitz. However, Riley & Godfrey, acting as first revisers, pointed out the error of Hewitson (1869) and selected his unfigured male to represent *melisa*, so leaving *cyara* valid for this subspecies, the situation being consolidated by Evans.

This subspecies is rare but now well known from Sikkim and reputedly spans the Ganges basin to north-west Burma, but I can find neither definite records nor specimens from there. The distinctive white patch on the male fore wing, and to some extent the underside, are interesting parallels to *D. achaja*.

MATERIAL EXAMINED.

*Myrina cyara* Hewitson, ♀ holotype, INDIA: West Bengal (north), Darjeeling (ex coll. Hewitson).

INDIA: West Bengal (north), 1 ♂ (*Myrina melisa* Hewitson syntype '♀'), Darjeeling. BHUTAN: 1 ♂, viii. 1892 (*G. C. Dudgeon*). SIKKIM: 2 ♂, Gangtok, 4000 ft, 21.viii.1934 (*J. N. Eliot*) (in coll. Eliot).

Note. It may be that the 'Darjeeling' examples were collected in Sikkim, but it is as likely that they were taken before the forests round Darjeeling were cleared.

### ***Drupadia scaeva cooperi*** (Tytler) **comb. n.**

[*Biduanda cyara* (Hewitson); Riley & Godfrey, 1921 : 187.]
*Biduanda melisa cooperi* Tytler, 1940 : 123. Holotype ♂, BURMA: Maymyo [examined].

This is a little-known subspecies, not in Cantlie (1963). The female remains much as that of *D. s. cyara*, but smaller. The male, however, is very close to *D. s. melisa*, only the hind wing is dark purple-blue instead of blue.

MATERIAL EXAMINED.

*Biduanda melisa cooperi* Tytler, holotype ♂, BURMA: north-east [Maymyo], Anisakan, 14.ix.1926 [*G. Cooper*]. [Anisakan is 'the waterfall below Maymyo' Evans, 1922 : 516].

Paratype. THAILAND: S.E., 1 ♂, [near Sri Racha, south-east of Bangkok] Nong Khai Ploy, 21.iv.1914 (*E. J. Godfrey*).

THAILAND: north, 1 ♀, Phrae, Me Song, 24.iv.1916 (*E. J. Godfrey*); south-east, 1 ♂ (wings only), Chantabun, Khao Sabap, iii. 1934 (*J. Macbeth*).

### ***Drupadia scaeva melisa*** (Hewitson) **comb. n.**

(Pl. 3, figs 78, 82)

*Myrina melisa* Hewitson, 1869 : Suppl. p. 6 [not figured]. LECTOTYPE ♂, here designated BURMA (BMNH) [examined].
*Biduanda melisa* (Hewitson); Doherty, 1889 : 425.
*Biduanda melisa* (Hewitson); Riley & Godfrey, 1921 : 187.
*Biduanda melisa* (Hewitson); Evans, 1921 : [38], no. 37f, ♀.
[*Biduanda nicevillei* Doherty; Ollenbach, 1921 : 134, pl. 27, fig. 14, ♀. Misidentification.]
*Biduanda melisa melisa* (Hewitson); Evans, 1925 : 766, pl. 29, fig. 77.1.
*Biduanda melisa* (Hewitson); Seitz, 1926 : 988, pl. 159, fig. f4 (as *scaeva* ♀).
*Biduanda scaeva melisa* (Hewitson); Corbet, 1940 : 6.
*Marmessus scaeva melisa* (Hewitson); Cantlie, 1963 : 135.

In the BMNH type collection are Hewitson's syntypes of *Myrina melisa*, the male being that of the present subspecies and the 'female' being the male from Darjeeling whose female he later named *Myrina cyara*. Riley & Godfrey stated the correct situation and established the present usage of the names, to safeguard which I now formally designate the male syntype as lectotype of *Myrina melisa* Hewitson.

The full situation was not realized by Corbet in 1940, and he cited the Seitz figures without comment. Evans first separated the female from that of *D. estella nicevillei*, which it very closely resembles in Burma; but in the same publication Ollenbach reversed their identities.

This subspecies is well represented in the BMNH from the Moulmein area southwards to Victoria Point, the extreme south of Burma, all dated specimens being in November to March, the dry season. The pair from Ranawng, just across the Thailand border, is undated, but I think the only time Doherty visited Ranawng was in December 1890, *en route* from Marang and Enggano *via* Singapore and Perak to Calcutta (Hartert, 1901 : 498). These are partial dwarfs (fore wing 12 mm against the normal 13–14 mm), the male hind wing being dull blue instead of shining, and lacking the orange costal stripe usual in this subspecies. Three other males in the main series have the orange stripe obsolescent, and it is thought that these are intermediates to dwarfs.

The clinal area between subspecies *melisa* and *scaeva* lies between Ranawng and Perlis, on the northern boundary of which I have taken a female of the latter.

MATERIAL EXAMINED.

*Myrina melisa* Hewitson, lectotype ♂, BURMA: south, Moulmein.

BURMA: 47 ♂, 42 ♀, Moulmein area southwards; THAILAND: south, 1 ♂, 1 ♀ (dwarfs), [xii. 1890] (*W. Doherty*).

### ***Drupadia scaeva scaeva*** (Hewitson) **comb. n.**

(Pl. 3; figs 79, 80, 83, 84)

*Myrina scaeva* Hewitson, 1863 : 30, pl. 15, figs 39, 40. Holotype ♂, SINGAPORE (BMNH) [examined].
*Biduanda scaeva* (Hewitson); Nicéville, 1890*b* : 210, pl. E, fig. 7, ♀.
*Biduanda scaeva* (Hewitson); Seitz, 1926 : 988, pl. 159, figs f2, f3.
*Biduanda scaeva scaeva* (Hewitson); Corbet, 1940 : 6.
*Marmessus scaeva scaeva* (Hewitson); Corbet, 1956 : 351, 479.

There seems little significant difference between the continental Malayan, Sumatran, and Bornean specimens of this species, except that the females from Sabah have brighter markings below.

The male upperside fore wing patch, white in *D. s. cyara*, obsolete in *D. s. cooperi* and *melisa*, here reappears as a silvery blue, matching the hind wing. The female is the usual dark brown with the tornal third of the hind wing bluish white. The underside is chequered, brown to chocolate-brown on white, instead of etched in outline, with the female fore wing apex more orange than in the male. The fore wing length is normally 12–14 mm, but a fine large pair from Pulo Tioman, of 15 mm, has been shown me by Mr G. C. Stubbs, and both he and Mr J. A. Hislop have dwarf males from the peninsula, of 10 mm, similar to one in the BMNH from Sumatra. These have no blue patch on the fore wing and, of course, no lobe on the fore wing or brand on the hind wing, and the hind wing blue is restricted and dull. They appear to be straightforward examples of the dwarf phenomenon discussed above under *D. ravindra*, and again below under *D. cineas*.

Corbet first established the conspecificity of *scaeva* and *melisa*, but he did not correct the names on Seitz's plates. In 1956 (p. 479) he asserted that *Myrina scaeva* must have been taken by Wallace on Mount Ophir and not in Singapore, but this is by no means certain. There was plenty of jungle (and tigers) on Singapore island in Wallace's day, and this species is not confined to mountains. I have taken both sexes in swampy jungle just above sea level in south-east Johore.

MATERIAL EXAMINED.

*Myrina scaeva* Hewitson, holotype ♂, SINGAPORE [*A. R. Wallace*].

WEST MALAYSIA: 10 ♂, 1 ♀, throughout the peninsula; 1 ♂, 1 ♀, Pulo Tioman, x. 1958, vii. 1958 (*G. C. Stubbs*) (in coll. Stubbs); Selangor, 1 ♂ (dwarf), Genting Sempak, 28.iv.1957 (*G. C. Stubbs*) (in coll. Stubbs); Trengganu, 1 ♂ (dwarf), Kuala Tahan, 22.i.1958 (*J. A. Hislop*) (in coll. Hislop); Langkawi Is, 1 ♀, 21.i.1939 (*J. N. Eliot*) (in coll. Eliot)[3]. INDONESIA: N.E. Sumatra, 16 ♂, 4 ♀ (1 dwarf ♂) [no localities]; W. Sumatra, 1 ♂, 2 ♀ [no localities]. EAST MALAYSIA: Sabah, 4 ♀; Sabah, 1 ♀, Apas, 21.vii.1961 (*T. Norman*) (in coll. Norman); Sabah, 1 ♂, x. 1918 (*Woollett*).

### ***Drupadia cineas*** (Grose-Smith) **comb. n.**

(Text-fig. 9; Pl. 4, figs 85–92; Pl. 6, fig. 108)

[*Myrina cinesia* ♀ Hewitson, 1863 : 29, pl. 13, fig. 20. Misidentification.]
*Sithon cineas* Grose-Smith, 1889 : 318. LECTOTYPE ♂, here designated, EAST MALAYSIA: Sabah (BMNH) [examined].
*Biduanda hewitsonii* Druce, 1895 : 615. Holotype ♀, EAST MALAYSIA: Sabah (BMNH) [examined]. **Syn. n.**
*Biduanda hewitsonii* Druce; Druce, 1896 : 679, pl. 31, fig. 9 (♂).
*Biduanda cineas* (Grose-Smith); Moulton, 1911 : 163 [not seen by him].
*Biduanda hewitsonii* Druce; Moulton, 1911 : 163.
*Biduanda hewitsonii* Druce, var. *parva* Moulton, 1911 : 164. 1 ♂, 2 ♀ syntypes, EAST MALAYSIA: Sarawak (♂ in BMNH, ♀♀ not located) [♂ syntype examined]. **Syn. n.**
*Hypolycaena cineas* (Grose-Smith); Seitz, 1926 : 985 [not seen by him].
*Hypolycaena hewitsonii* (Druce); Seitz, 1926 : 985, pl. 146B, fig. e4, pl. 159, fig. h7 (wrongly as '*parva*').

The male upperside is shining bright blue with black margins of varying width, and with a subtornal white spot and white cilia on the hind wing (fig. 85, showing the large fore wing lobe). The female (fig. 88) is very dark brown, the hind wing with a white subtornal band in spaces 1 to 3 divided by dark veins, and white cilia. The underside (figs 89–92) is chalky white, shading at each wing apex to pale grey in the male and dull orange in the female, the hind wing marked with wavy postdiscal, and lunulate submarginal, black bands, the latter being centred by lunules of metallic shining blue. The normal fore wing length is 16–17 mm.

The remarkable dwarf, variety *parva* Moulton, whose fore wing may be as short as 12 mm, retains the normal upperside appearance in the female but in extreme males (figs 86, 90) is plain dark brown with a subtornal white spot on the hind wing and the black markings showing through from below. This male lacks brands and lobes, even in intermediates marked with blue (figs 87, 91), with a fore wing length of up to 15 mm.

Moulton's syntype male and 'female' of variety *parva* purport to be in the BMNH type collection. The male is a small intermediate with some blue on the upperside and fully agrees with the original description and data. But the 'female' is an extreme dwarf male, labelled Matang Road, 27.iv.1911. Moulton's two syntype 'females' were taken in October 1909, so the specimen in the BMNH cannot be one. I do not designate the male as lectotype because one of the two syntype 'females', if found and if likewise extreme dwarfs, would be preferable. The genitalia of both specimens in the BMNH have been examined, and appear identical in size and shape to those of normal males.

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[3] This specimen was recorded by Corbet (1940 : 6) as *D. s. melisa*. It is intermediate, and discovery of the male from Langkawi may prove it a new subspecies.

Dwarfs, combined with Hewitson's misidentification of the female *Myrina cinesia* (the last species below), have confused the nomenclature. Hewitson commented that, oddly, his female was smaller than the male. Grose-Smith had before him one normal male and one male dwarf. Assuming that they were a pair neatly conforming to the same peculiarity, he described them as male and female. His syntypes, long lost, have been rediscovered in the Rothschild collection (figs 85, 86, 89, 90). I now designate the male syntype (figs 85, upperside; 89, underside) as lectotype of *Sithon cineas* Grose-Smith. The type locality is Mount Kina Balu, Sabah (Grose-Smith, 1889 : 312).

Druce described a normal female, rightly equating it with that of *Myrina cinesia* as described in error by Hewitson, naming it *Biduanda hewitsonii*, which thus is a subjective synonym of *Sithon cineas* Grose-Smith. In the following year he described and figured a normal male under the same name. Both his specimens, labelled as 'types', are in the BMNH, but the latter is, of course, not a primary type. Druce remarked on Grose-Smith's odd 'female', and asserted that there must be two species. Moulton followed him, and so did Seitz, neither being able to identify *Sithon cineas* Grose-Smith.

Dr T. Norman kindly let me see a series of about six males from Sabah which are intermediate dwarfs, all lacking male insignia and with varying amounts of blue on the upperside and with fore wing lengths about 14–15 mm. With only two such examples in the BMNH there was a possibility that '*Biduanda parva*' Moulton might be a good species, but these specimens give convincing proof that *Drupadia cineas* and its dwarf variety *parva* are yet another, and a good, example of the dwarfing phenomenon.

MATERIAL EXAMINED.

*Sithon cineas* Grose-Smith, lectotype ♂, EAST MALAYSIA: 'N. Borneo' [Sabah Kina Balu (*J. Whitehead*) from description]. *Biduanda hewitsonii* Druce, holotype ♀, EAST MALAYSIA: Sabah, Ellopura [=Sandakan] (*W. B. Pryer*). *Biduanda hewitsonii* Druce, variety *parva* Moulton, syntype ♂ [see text above], EAST MALAYSIA: Sarawak, Kuching, 26.vi.1900.

Paralectotype. *Sithon cineas* Grose-Smith, syntype '♀' [a ♂, var. *parva*], EAST MALAYSIA: 'N. Borneo' [Sabah, Kina Balu (*J. Whitehead*) from description].

Paratype. *Biduanda hewitsonii* Druce, paratype ♀ (and syntype misidentified paralectotype ♀ of *Myrina cinesia* Hewitson), EAST MALAYSIA: Sarawak [*Wallace*].

INDONESIA: West Kalimantan, 1 ♂, Silat, Kelam, iii. 1910. EAST MALAYSIA: Sarawak, 1 ♂, 3 ♀ (various localities); Sabah, 9 ♂, 18 ♀ various localities).

Note. Mr J. A. Hislop recently sent me an accurate sketch of a good full-sized male which he found in S.E. Kalimantan, 'a day's journey up the Sentan river' [on the equator, about 117°E.], a useful extension of the range.

### ***Drupadia cinesoides*** (Nicéville) **comb. n.**

(Text-fig. 11; Pl. 4, figs 93, 96; Pl. 6, fig. 109)

*Biduanda cinesoides* Nicéville, 1889 : 166, pl. A, fig. 7. Holotype ♂, West Malaysia: Selangor (not located).
*Biduanda cinesoides* Nicéville; Nicéville, 1890*b* : 211, pl. E, fig. 8, ♀.
*Biduanda cinesioides* Nicéville; Nicéville & Martin, 1896 : 480.
*Hypoycaena cinesioides* (Nicéville); Seitz, 1926 : 986, pl. 159, figs c2, c3.
*Ritra cinesia cinesoides* (Nicéville); Corbet, 1956 : 348.

The male, well illustrated by Seitz, has a rather thinly scaled, pinkish blue upperside, with an ovate patch of modified scales round the bases of spaces 4 and 5 on the fore wing, and a black brand like that of *D. cinesia* round the base of space 7 on the hind wing. The undersides of this and the two remaining species, as well as the female uppersides, are like the male of *D. johorensis* (figs 94, 97). The fore wing length is 18–21 mm.

*D. cinesoides* and *D. johorensis* can be separated at a glance from *D. cinesia* since the last lacks the subtornal red bar at the dorsum of the hind wing underside. This small distinction covers an extreme difference in the male genitalia, which in *D. cinesia* (fig. 111) are small and compact, whereas they are very bulky in *D. cinesoides* (fig. 109) and *D. johorensis* (fig. 110). The 'red bar' in the last two is an infallible diagnostic, but although there must be some pre-historic connection between this bar and the 'red ribbon' of *D. rufotaenia*, the comparison is not a simple one. The red ribbon assists in separating some subspecies of *D. rufotaenia* from the larger, dimorphic, *D. ravindra*. The comparable species here are *D. johorensis* and the larger, dimorphic, *D. cinesoides*, but both have the bar. It is the further large dimorphic *D. cinesia* which lacks it. Moreover, *D. ravindra* and *D. rufotaenia* are everywhere compatriate. So are *D. cinesoides* and *D. johorensis*; but *D. cinesia*, so far as known, is totally allopatric.

De Nicéville described and figured a then unique male. In the following year he similarly published the female, also from peninsular Malaya, and later, with Martin, he reported the species as rare in N.E. Sumatra. His male holotype has not been located.

MATERIAL EXAMINED.

West Malaysia: 1 ♀, 'Perak' [no further data; possibly *H. Low*]; 1 ♂, Pahang, Fraser's Hill, 3.v.1959 (*G. C. Stubbs*); 3 ♀, Pahang, Genting Sempak, 28.iv.1957, 5.x.1958, 14.xii.1958 (*G. C. Stubbs*); 1 ♀, Johore, Lenggor, 9.v.1948 (*G. C. Stubbs*) (all in coll. Stubbs); 1 ♀, Perak, Kinta (*J. A. Hislop*); 1 ♀, Johore, Jemaluang (*J. A. Hislop*) (both in coll. Hislop). Indonesia: 1 ♂, N.E. Sumatra (*Martin*); 1 ♂, 2 ♀, N.E. Sumatra, Battack Mountains (*Martin*); 1 ♂, Sumatra (*Evans*); 1 ♂, 'N. Borneo' (ex coll. Fruhstorfer).

Note. I do not think Fruhstorfer himself collected the last listed specimen, and strongly suspect that the locality label is wrong. Fruhstorfer did not know this species, and did not mention it in his thorough *Uebersicht* of 1912. Seitz does not give Borneo for the species, and I think the specimen was probably from 'N.E. Sumatra (*Martin*)'.

### ***Drupadia johorensis*** (Cowan)

(Pl. 4, figs 94, 97; Pl. 6, fig. 110)

*Marmessus johorensis* Cowan, 1958 : pl. 4, (p. 87). LECTOTYPE ♂, here designated, WEST MALAYSIA: Johore (BMNH) [examined].
*Drupadia johorensis* (Cowan); Nieuwenhuis, 1969 : 218, figs 16, 17.

The species was named by accident. Editorial policy was not to introduce new names, so my description of the brown pair taken *in cop.*, both resembling the female *cinesoides*, was altered. But the name was not deleted from the plate, which suffices to validate it. Of the pair, I now designate the male as lectotype of *Marmessus johorensis* Cowan.

Originally, only the pair and another female, all from low-lying jungle in Johore, were known. When the peculiarities of the genus were realized, more males were quickly found in old series of female *D. cinesoides* from peninsular Malaysia and from Sumatra.

Described in the key and figured; the fore wing length is 17–18 mm.

MATERIAL EXAMINED.

*Marmessus johorensis* Cowan, lectotype ♂, WEST MALAYSIA: Johore, 36 miles N.W. of Johore Baharu, 200 ft, 2.i.1937 (*C. F. Cowan*).

Paralectotype ♀, taken *in cop.* with lectotype; same data.

WEST MALAYSIA: Johore, 1 ♀, Kangkar Dohol, 50 ft, 7.viii.1938 (*C. F. Cowan*); Negeri Sembilan, 1 ♂, Tampin, 16.iii.1920 (*J. W. Scharff*); Pahang, 1 ♂, Frasers Hill, 17.x.1933 (*J. E. Kempe*); 1 ♂, 1 ♀, Genting Sempak, 22.i.1957, 7.iv.1957 (*G. C. Stubbs*) (in coll. Stubbs); INDONESIA: W. Sumatra, 1 ♂, Padang Bovenlanden, Batang Proepoe (*Van der Poll*); N.W. Sumatra, 1 ♂, Atjeh, Meulaboh, 17.i.1954 (*R. Straatman*) (in Rijksmuseum van Natuurlijke Historie, Leiden).

Note. Mr E. J. Nieuwenhuis of Rotterdam, who detected the last specimen listed, very kindly arranged for me to examine it.

### ***Drupadia cinesia*** (Hewitson) **comb. n.**

(Text-fig. 10; Pl. 4, figs 95, 98; Pl. 6, fig. 111)

*Myrina cinesia* Hewitson, 1863 : 29, pl. 13, figs 18–20. LECTOTYPE ♂, here designated, EAST MALAYSIA: Sarawak (BMNH) [examined].
*Biduanda cinesia* (Hewitson); Druce, 1895 : 614.
*Biduanda cinesia* (Hewitson); Moulton, 1911 : 163.
*Hypolycaena cinesia* (Hewitson); Seitz, 1926 : 986, pl. 146B, figs g1, g2.

This species is apparently confined to Borneo, where neither of the last two species occurs.

The male upperside is much darker, and more blue, than that of *D. cinesoides*, and the fore wing lacks the discal brand. The female, and the underside, are of exactly the same pattern as the last two species except that the hind wing subtornal 'red bar' is lacking from the underside. The fore wing length is 18–22 mm.

The male genitalia are very different. Extremely small compared with most of the genus (and of more normal Lycaenid size), they approach those of *D. ravindra*, and are a link with the *Cheritra* pattern, notably the isolated *Cheritrella truncipennis* Nicéville (Cowan, 1967 : pl. 3, fig. 25), which almost match for size.

Hewitson described and figured both sexes simultaneously, but they are different species. The syntypes are in the BMNH. Druce was the first reviser, describing the correct female and then proposing the name *Biduanda hewitsonii* for the original misidentified species. In formal confirmation of this I now designate Hewitson's male syntype as lectotype of *Myrina cinesia* Hewitson.

### MATERIAL EXAMINED.

*Myrina cinesia* Hewitson, lectotype ♂, EAST MALAYSIA: Sarawak [*Wallace*].

EAST MALAYSIA: Sarawak; 1 ♂, Bidi, vii. 1907 (*C. J. Brooks*); 1 ♀, Kuching; Sabah; 12 ♂, 18 ♀, Kina Balu; 1 ♀, Lawas (*Everett*); 1 ♀, Ellopura [Sandakan] (*Pryer*); 1 ♂, 2 ♀, 'N. Borneo'. BRUNEI: 1 ♂, 1 ♀ (no data) (*Waterstradt*).

## SYNONYMIC LIST OF *DRUPADIA*

For simplicity, national divisions are omitted; 'Borneo' is used for the whole island, and 'Malaya' is used for West Malaysia.

| | |
|---|---|
| ***DRUPADIA*** Moore, 1884 | |
| *Biduanda* Distant, 1884 | |
| [*Marmessus* Nicéville, 1890. Misapplication.] | |
| ***achaja*** (Fruhstorfer, 1912) | Thailand. |
| ***ravindra corbeti*** **nom. n.** | Pulo Condor (South Vietnam). |
| *lisias* (Fabricius, 1787) | |
| ***ravindra boisduvalii*** Moore, 1884 | Burma, Thailand, Vietnam. |
| *alcira* (Fruhstorfer, 1912) | |
| ***ravindra moorei*** (Distant, 1882) | Malaya, Sumatra, Borneo. |
| *similis* (Druce, 1895) **syn. n.** | |
| *sumatrana* (Fruhstorfer, 1912) **syn. n.** | |
| *battakana* (Fruhstorfer, 1912) **syn. n.** | |
| *nola* (Fruhstorfer, 1912) **syn. n.** | |
| ***ravindra serunica*** (Eecke, 1914) | Simeulue Is. |
| ***ravindra caesarea*** Weymer, 1887 | Nias Is. |
| *niasicola* (Staudinger, 1889) (nec *niasica*) | |
| *comla* (Swinhoe, 1912) | |
| ***ravindra batuna*** (Riley, 1944) | Batu Is. |
| ***ravindra connexa*** (Riley, 1944) | Siberut, Sipora Is. |
| ***ravindra esla*** (Swinhoe, 1912) | N.W. Sumatra. |
| *iskander* (Fruhstorfer, 1912) **syn. n.** | |
| ***ravindra sumptuosa*** (Toxopeus, 1931) | W. Sumatra. |
| ***ravindra janus*** (Riley, 1944) | S.W. Sumatra. |
| ***ravindra ravindra*** (Horsfield, 1828) | Java. |
| *medullia* (Fruhstorfer, 1912) | |
| *javanica* (Toxopeus, 1932) **syn. n.** | |
| *transiens* (Kalis, 1933) | |
| ***ravindra balina*** (Fruhstorfer, 1914) | Bali. |

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|---|---|
| ***ravindra banka*** (Riley, 1944) | Bangka Is. |
| ***ravindra lisiades*** (Fruhstorfer, 1912) | Central Borneo. |
| ***ravindra fulminans*** (Staudinger, 1889) | E. Borneo. |
| *atra* (Druce, 1896) **syn. n.** | |
| ***ravindra surindra*** (Druce, 1895) | N.E. Borneo. |
| ***ravindra joloana*** (Staudinger, 1889) | Sulu Is. |
| *albula* (Druce, 1895) **syn. n.** | |
| ***ravindra ravindrina*** (Staudinger, 1889) | Palawan Is. |
| ***ravindra resoluta*** **subsp. n.** | Philippines. |
| ***rufotaenia archbaldi*** (Evans, 1932) | S. Burma. |
| ***rufotaenia rufotaenia*** (Fruhstorfer, 1912) | Malaya. |
| ***rufotaenia alcyma*** (Riley, 1944) | S.W. Sumatra. |
| ***rufotaenia caesia*** **subsp. n.** | Nias Is. |
| ***rufotaenia kina*** **subsp. n.** | Borneo. |
| ***rufotaenia torquata*** **subsp. n.** | Palawan Is. |
| ***rufotaenia praecox*** **subsp. n.** | Philippines. |
| ***cinderella*** **sp. n.** | Borneo. |
| ***cindi*** **sp. n.** | Borneo. |
| ***araotina*** (Evans, 1933) | Malaya. |
| ***abnormis*** (Moulton, 1911) | Borneo. |
| ***theda fabricii*** Moore, 1884 | Burma, Thailand. |
| *imitata* (Druce, 1895) | |
| ***theda renonga*** (Corbet, 1938) | Thailand peninsula, Langkawi Is. |
| ***theda thesmia*** (Hewitson, 1863) | Sumatra, Malaya. |
| *minara* (Fruhstorfer, 1912) | |
| ***theda demialba*** (Staudinger, 1889) | Nias Is. |
| ***theda batunensis*** (Fruhstorfer, 1912) | Batu Is. |
| ***theda albicans*** (Riley, 1944) | Sipora, Siberut Is. |
| ***theda pagiensis*** (Riley, 1944) | N. Pagi Is. |
| ***theda fulgens*** **subsp. n.** | Bangka Is. |
| ***theda umara*** (Fruhstorfer, 1912) | N.E. Borneo. |
| *depicta* (Fruhstorfer, 1912) | |
| ***theda vanica*** (Fruhstorfer, 1912) | S. Borneo. |
| ***theda unicolor*** (Staudinger, 1889) | Palawan. |
| ***theda theda*** (C. & R. Felder, 1862) | Philippines. |
| ***theda thaliarchus*** (Staudinger, 1888) | N. Sulawesi. |
| *inexpectata* (Ribbe, 1926) **syn. n.** | |
| ***theda namusa*** (Hewitson, 1863) | S. Sulawesi. |
| *naenia* (Hewitson, 1863) | |
| ***theda bangkaiensis*** (Ribbe, 1926) | E. Sulawesi. |
| ***niasica scudderii*** (Doherty, 1889) | S. Burma. |
| ***niasica biranta*** (Riley, 1942) | Langkawi Is. |
| ***niasica perlisa*** (Riley, 1942) | Malaya. |
| ***niasica niasica*** (Röber, 1886) | Nias Is. |
| ***niasica ianthina*** **subsp. n.** | Batu Is. |
| ***niasica karnyi*** (Riley, 1944) | Mentawei Is. |
| ***niasica dohertyi*** (Riley, 1944) | S.W. Sumatra. |
| ***niasica ultra*** **subsp. n.** | S. Borneo. |
| ***niasica thaenia*** (Druce, 1895) | N.E. Borneo. |
| ***niasica florens*** **subsp. n.** | Philippines. |
| ***estella nicevillei*** (Doherty, 1889) | S. Burma. |
| ***estella semperna*** (Corbet, 1944) | Malaya. |
| ***estella estella*** (Hewitson, 1863) | Sumatra, Borneo. |
| ***scaeva cyara*** (Hewitson, 1878) | Sikkim. |

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|---|---|
| ***scaeva cooperi*** (Tytler, 1940) | N. Burma, N. Thailand. |
| ***scaeva melisa*** (Hewitson, 1869) | S. Burma, S. Thailand. |
| ***scaeva scaeva*** (Hewitson, 1863) | Malaya, Sumatra, Borneo. |
| ***cineas*** (Grose-Smith, 1889) | Borneo. |
| *hewitsonii*( Druce, 1895) **syn. n.** | |
| *parva* (Moulton, 1911) **syn. n.** | |
| ***cinesoides*** (Nicéville, 1889) | Malaya, Sumatra. |
| ***johorensis*** (Cowan, 1958) | Malaya, Sumatra. |
| ***cinesia*** (Hewitson, 1863) | Borneo. |

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**resoluta**, 298, **313**, 319
rufotaenia, 290, 291, 293, 296, 297, 304, 314–319, **316**, 333

scaeva, 288, 289, 291, 294, 341–**344**
scudderii, **334**
semperna, **340**

serunica, 286, 299, **304**
*similis*, **302**
*sumatrana*, **302**
sumptuosa, 286, 299, **306**
surindra, 296, 298, **311**, 318

thaenia, 334, **337**, 339
thaliarchus, 324, **331**
theda. 288, 289, 291–293, 304, 316, 322–333, **330**, 338, 339
thesmia, 323, **325**
**torquata,** 315, **318**
*transiens*, **307**, 308

**ultra**, 334, **337**
umara, 323, **328**, 329
unicolor, 323, **329**, 330

vanica, 323, **328**

Lt-Col. C. F. Cowan
Little Gaddesden House
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Hertfordshire HP4 1PL

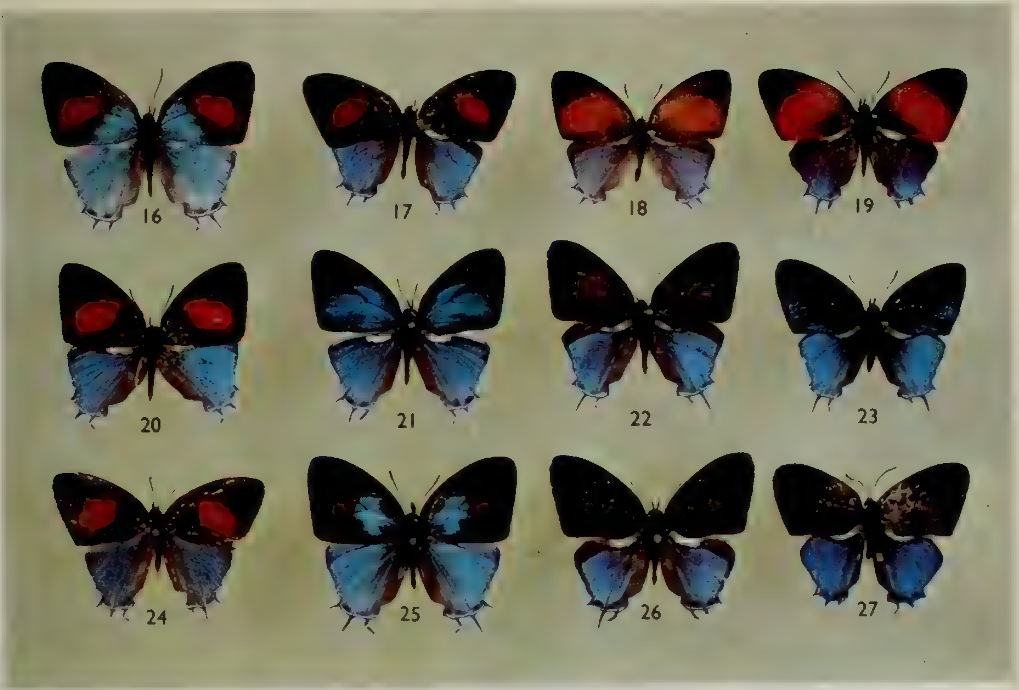
## PLATE 1

Representative subspecies of *Drupadia ravindra;* males
Figures 16–27, uppersides; 28–39, undersides. Scale × ·80.

| | | |
|---|---|---|
| Figs 16, 28 | *D. rav. caesarea* | Nias Is. (*Fruhstorfer*) |
| 17, 29 | *esla* | N.W. Sumatra, Padang (*Ericsson*) |
| 18, 30 | *boisduvalii* | Central Burma, Karens (*Mackwood*) |
| 19, 31 | *fulminans* | E. Sabah, Sapagaya (*Cator*) |
| 20, 32* | *batuna* | Batu Is. (*Kannegieter*) |
| 21, 33* | *sumptuosa* | W. Sumatra, Lebong Tandai (*Brooks*) |
| 22, 34 | *moorei* | Malaysia, Perak (*Doherty*) |
| 23, 35 | *surindra* | Sabah, Melaman (*Woollett*) |
| 24, 36 | *connexa* | Siberut Is. (*Kloss & Smedley*) |
| 25, 37* | *janus* | S.W. Sumatra, Marang (*Doherty*) |
| 26, 38 | *ravindra* | W. Java, Depok |
| 27, 39 | *joloana* | Jolo Is. (*Fruhstorfer*) |

Notes. * not previously illustrated.

Fig. 22: specimen selected to show obsolescent fore wing flush.
Fig. 23: specimen selected showing blue fore wing streaks.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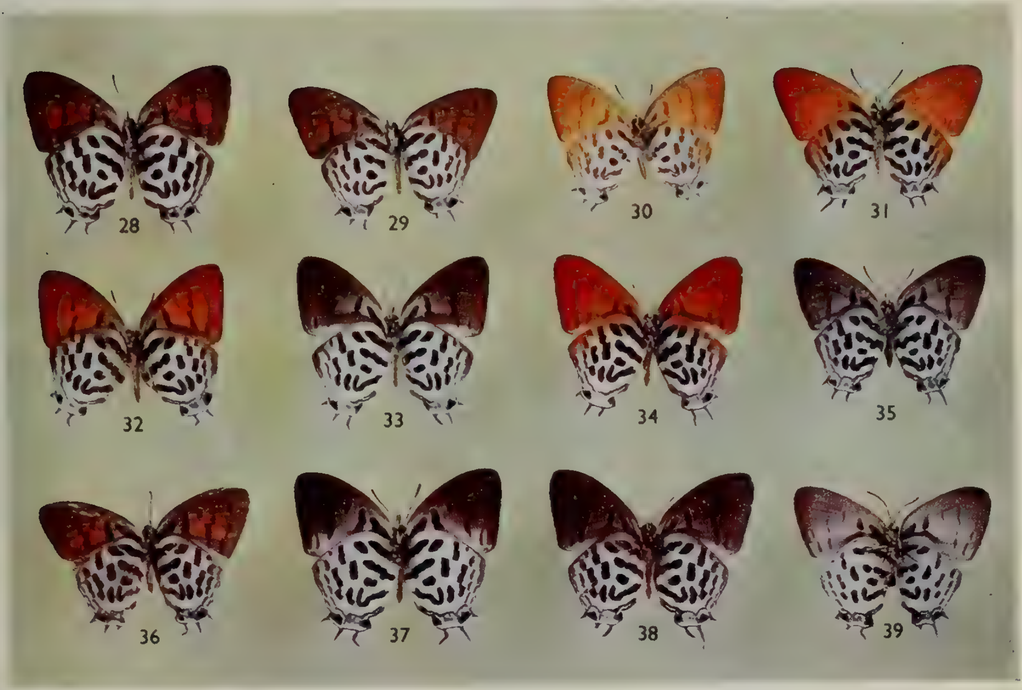
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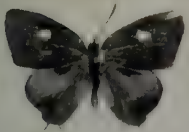
## PLATE 2

Representative species of *Drupadia;* males (except three noted)
Upperside above, underside below, in each pair of figures.

| | | |
|---|---|---|
| Figs 40, 44 | *D. achaja* | N. Thailand, Phrae (*Godfrey*) |
| 41, 45* | *araotina* ♀ Ht. | W. Malaysia, Selangor, Po. Angsa (*Evans*) |
| 42, 46* | *ravindra moorei* dwarf | Singapore (*Cowan*) |
| 43, 47 | *rufotaenia rufotaenia* | Singapore (*Cowan*) |
| 48, 51 | *abnormis* ♀ Pt. | Sarawak, Gunong Klingkang. |
| 49, 52* | *ravindra resoluta* Ht. | Philippines, Mindoro (*Everett*) |
| 50, 53* | *theda fulgens* Ht. | Bangka Is. (*Hagen*) |
| 54, 58* | *cinderella* Ht. | Sarawak (*Smeaton-Stuart*) |
| 55, 59* | *cindi* Ht. | Sabah (*Pryer*) |
| 56* | *cindi* ♀ Pt. | Sabah (*Pryer*) |
| 57, 60* | *estella semperna* Ht. | W. Malaysia, Frasers Hill (*Eliot*) |

Ht. = Holotype. Pt. = Paratype. * Not previously illustrated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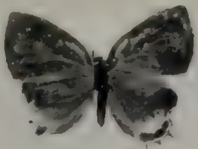
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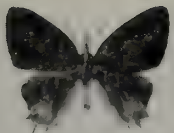
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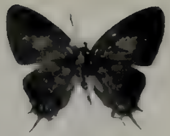
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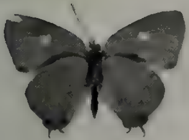
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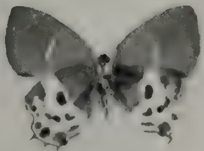
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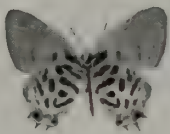
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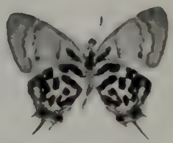
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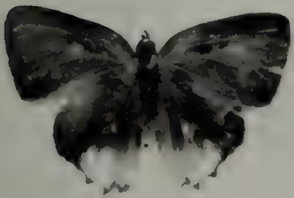
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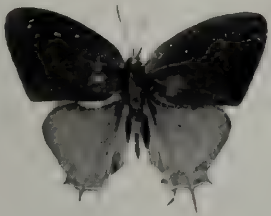
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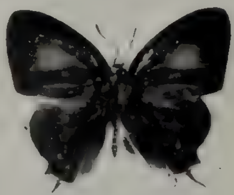
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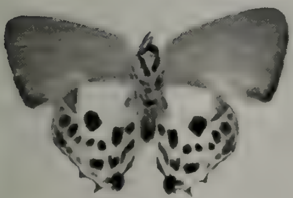
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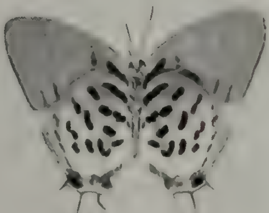
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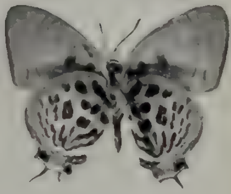
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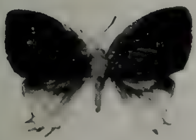
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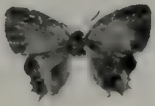
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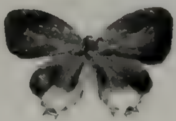
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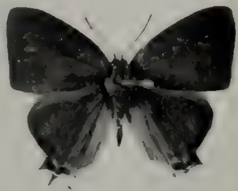
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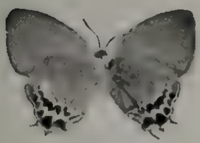
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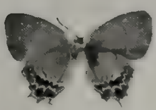
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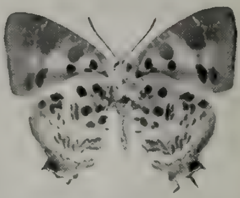
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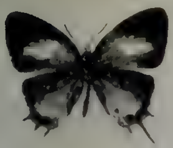
## PLATE 3

Subspecies of three rare *Drupadia* species; males

| | | |
|---|---|---|
| Figs 61, 65* | *D. rufotaenia* caesia Ht. | Nias Is. (*Raap*) |
| 62, 66* | *kina* Ht. | Sabah, Kina Balu (*Waterstradt*) |
| 63, 67* | *torquata* Ht. | Palawan (*Cator*) |
| 64, 68* | *praecox* Ht. | Phillippines, Mindoro (*Everett*) |
| 69, 73 | *D. niasica niasica* | [Nias Is.] |
| 70, 74* | *ianthina* Ht. | Pulo Telo (*Kannegieter*) |
| 71, 75* | *ultra* Ht. | S. Kalimantan, Po. Laut (*Doherty*) |
| 72, 76* | *florens* Ht. | Mindanao, Lanao (*Wileman*) |
| 77, 81 | *D. scaeva cyara* | Sikkim, Gangtok (*Eliot*) |
| 78, 82 | *melisa* | S. Burma, Mergui (*Evans*) |
| 79, 83 | *scaeva* | Sabah (*Woollett*) |
| 80, 84* | *scaeva* dwarf | W. Malaysia, Pahang (*Hislop*) |

Ht. = Holotype.  * Not previously illustrated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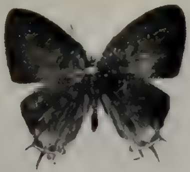
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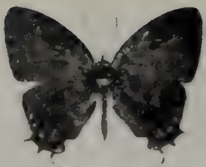
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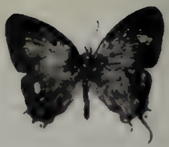
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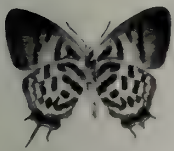
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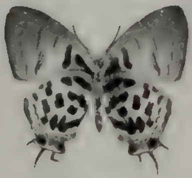
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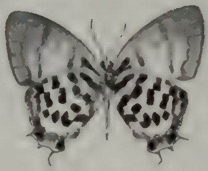
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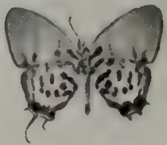
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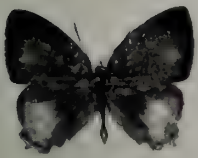
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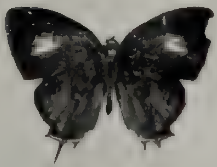
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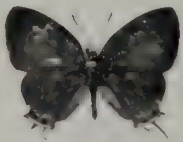
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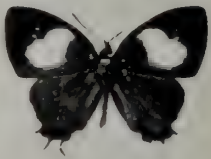
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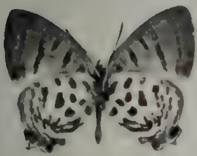
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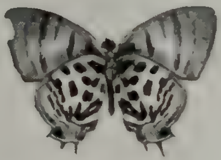
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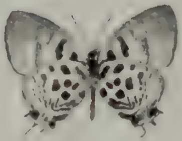
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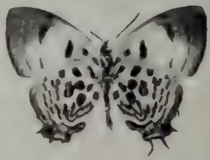
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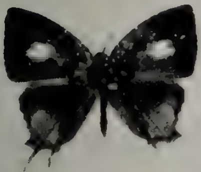
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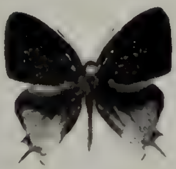
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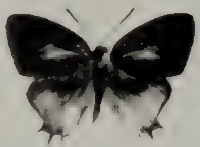
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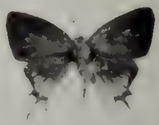
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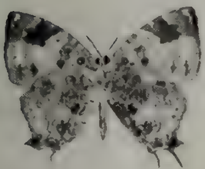
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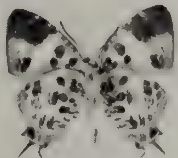
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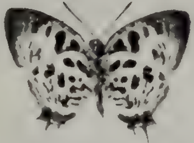
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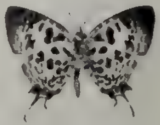
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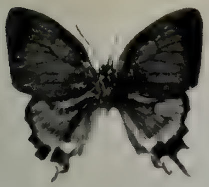
## PLATE 4

Four further species of *Drupadia;* males (except one noted)

| | | |
|---|---|---|
| FIGS 85, 89 | *D. cineas* Lt. | Sabah, Kina Balu (*Whitehead*) |
| 86, 90 | *cineas* '♀' St. ♂ var. *parva* | |
| 87, 91 | *cineas* intermediate var. | Sarawak, Kuching. |
| 88, 92 | *cineas* ♀ | Sarawak, Lawas (*Everett*) |
| 93, 96 | *cinesoides* | N. E. Sumatra (*Fruhstorfer*) |
| 94, 97 | *johorensis* | W. Sumatra, Batang Proepoe (*Van der Poll*) |
| 95, 98 | *cinesia* | Sabah, Kina Balu |

Note. The first two specimens are Grose-Smith's '♂ and ♀ types' of *D. cineas* Grose-Smith. Of these syntypes the former is designated as lectotype. The second is a ♂ var. *parva*, which has not previously been illustrated.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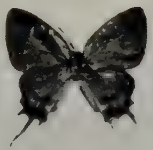
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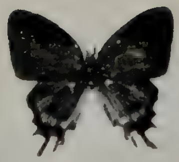
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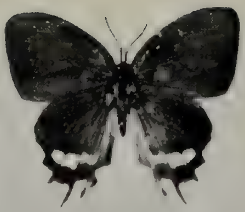
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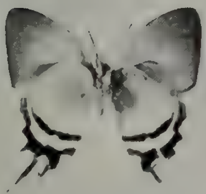
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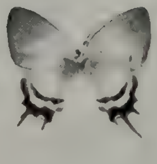
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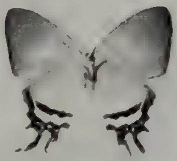
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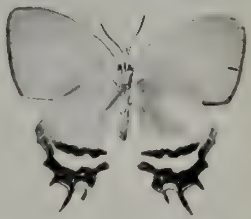
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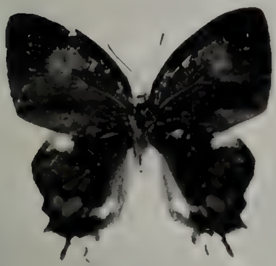
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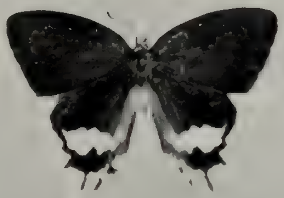
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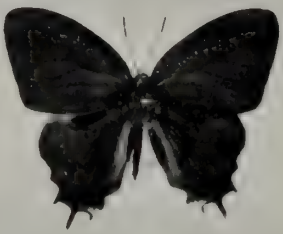
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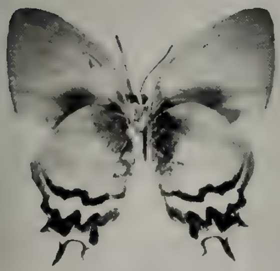
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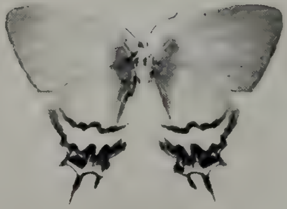
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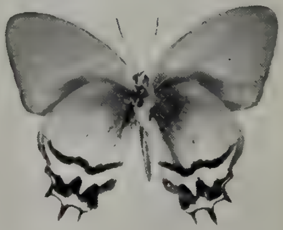
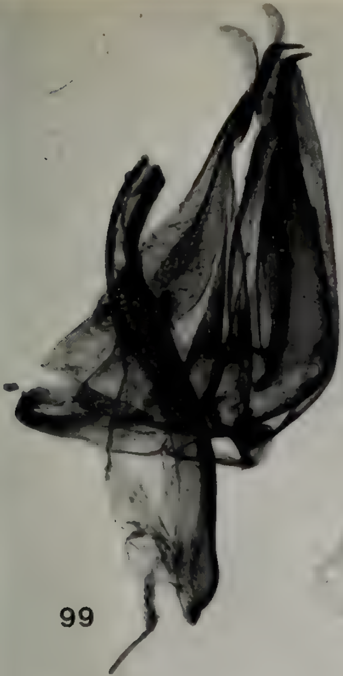

98

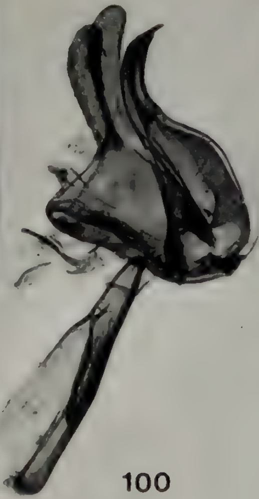
## PLATE 5

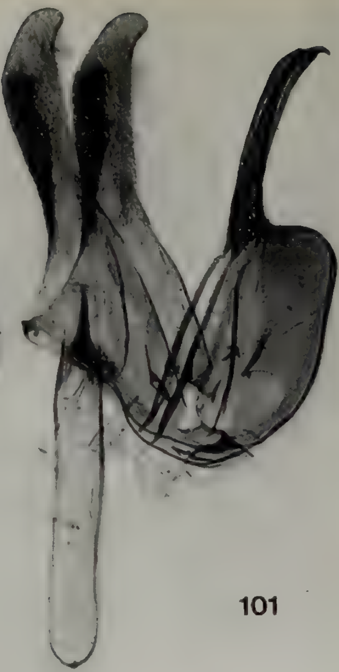
Male genitalia of *Drupadia*

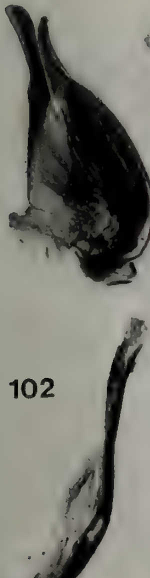
| | | | |
|---|---|---|---|
| Fig. 99 | *D. achaja* | Slide NHB1555 | Thailand |
| 100 | *ravindra* | NHB 1514 | Sabah |
| 101 | *rufotaenia* | ASC 46–252 | Singapore |
| 102 | *cinderella* | NHB 2421 | Sarawak |
| 103 | *cindi* Ht. | Hope/NHB 2478 | Sabah |
| 104 | *theda* | NHB 1475 | Mindanao |
| 105 | *niasica* | NHB 1465 | Mindanao |

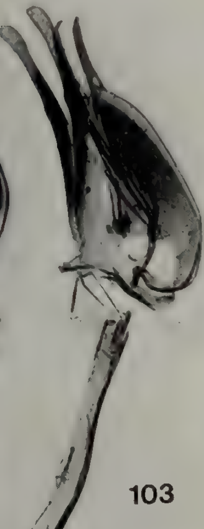
Notes. In figs 102, 104, 105 the vesica is everted; in others it is continent.

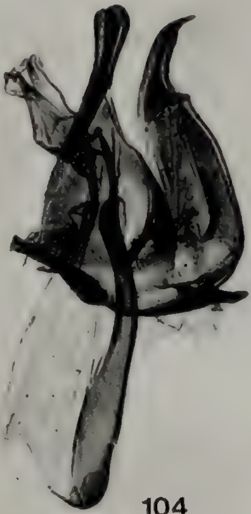

99


100


101


102


103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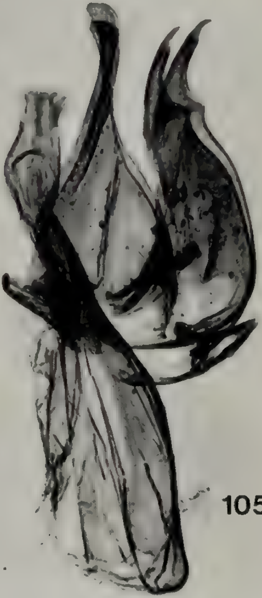
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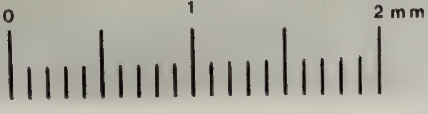
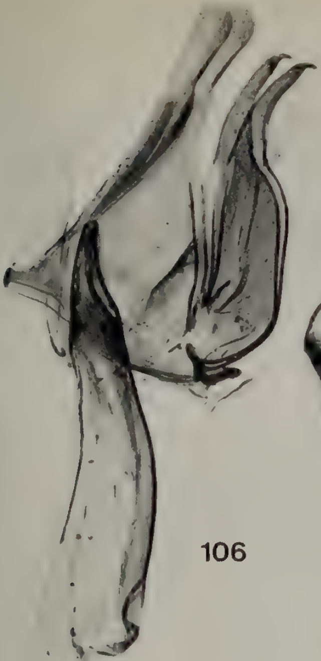


## PLATE 6

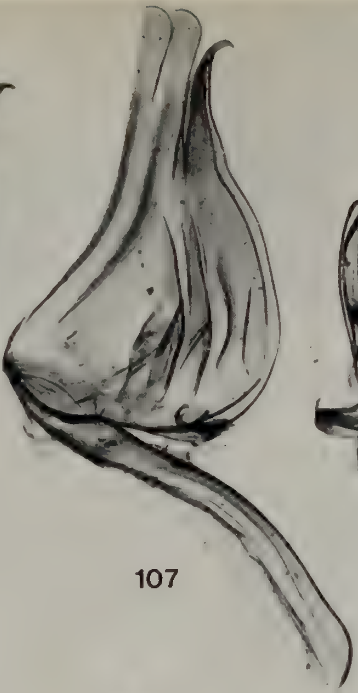
Male genitalia of *Drupadia* (contd)

| | | | |
|---|---|---|---|
| Fig. 106 | *D. estella* | Slide no. NHB 2454 | Sabah |
| 107 | *scaeva* | NHB 1478 | N.E. Sumatra |
| 108 | *cineas* | NHB 1438 | Borneo |
| 109 | *cinesoides* | NHB 1429 | 'Borneo' [N.E. Sumatra] |
| 110 | *johorensis* Ht. | NHB 1421 | Malaysia, Johore |
| 111 | *cinesia* | NHB 1422 | Borneo |

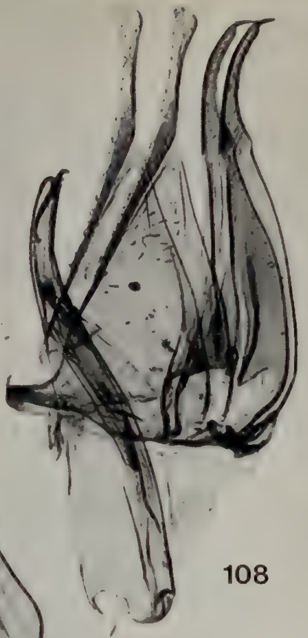
Note. In figs 109, 110 the vesica is partially everted.



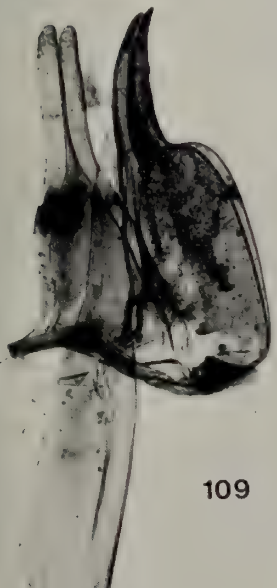
106



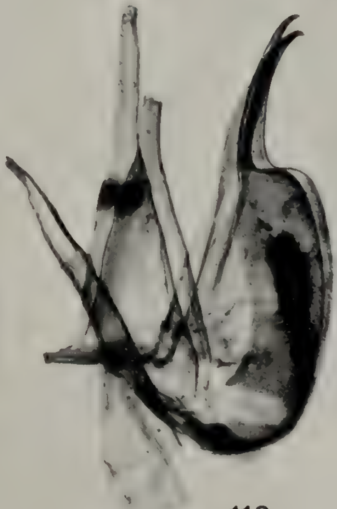
107



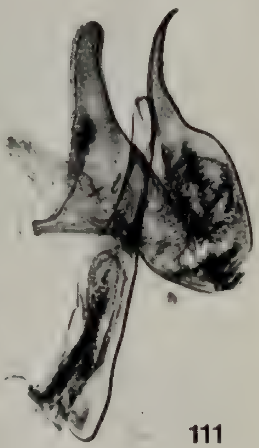
108



109



110



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# THE EVOLUTION OF THE HOLARCTIC LEAFHOPPER GENUS *DIPLOCOLENUS* RIBAUT, WITH DESCRIPTIONS AND KEYS TO SUBGENERA AND SPECIES (HOMOPTERA : CICADELLIDAE)

W. J. KNIGHT

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## SYNOPSIS

A possible phylogeny of the genus *Diplocolenus* Ribaut is constructed mainly on the basis of an analysis of characters of the male genitalia. The centre of origin and dispersal of the genus are also discussed. A new classification is proposed and keys and descriptions are given to the three subgenera and 35 species included within the genus. Eleven lectotypes and one neotype are designated and five new specific synonymies and three new generic synonymies proposed. Two former subspecies are raised to the rank of species and one earlier name reinstated.

## INTRODUCTION

The genus *Diplocolenus*, first described by Ribaut in 1946, is the second largest genus of grassland leafhoppers in the Deltocephaline tribe Jassargini. It contains 35 species and is predominantly Palaearctic in distribution, with only two species occurring in the New World. It comprises forms differing widely in colour and male genitalia, which have been variously segregated in the past as distinct genera or subgenera. Oman (1949 : 165) considered the Nearctic species *evansi* to be sufficiently distinct from the European species on the shape of the aedeagus to be placed in a separate genus which he called *Verdanus*. This was thought to be only a subgenus of *Diplocolenus* by Ribaut (1952 : 281), differing from the nominate subgenus by the absence of a dorsal tooth at the apex of the subgenital plate. At the same time he further segregated the subgenus *Erdianus* on the basis of a ventrally produced atrium. Later (Ribaut, 1959 : 404), he segregated a fourth subgenus, *Sabelanus*, on the presence of two pairs of apical processes on the aedeagus instead of the normal single pair. Emeljanov (1966 : 122) rejected the subgenus *Sabelanus* as an unnatural group and subdivided the genus into six subgenera principally on the structure of the subgenital plates.

The wide range of characters in the male genitalia, the majority of which have been previously neglected in the classification of the genus, suggested the present attempt to analyse the steps followed during the evolution of the group. The value of such a study lies in the resultant ability to evaluate the significance of the subgeneric groups previously proposed and to re-arrange the species, if necessary, into more natural groups in the light of the new findings. In a wider concept, it also assists, by the determination of the ancestral characters of the group and the changes that these have undergone, in a better understanding of the evolution of the tribe as a whole.

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## ABBREVIATIONS

The majority of the material examined is in the British Museum (Natural History), abbreviated throughout the text to BMNH. Additional material is deposited in the following institutions, referred to in the text by their respective abbreviations given below in parentheses: Universitetets Zoologiska Institution, Lund, Sweden (UZI, Lund); Naturhistoriska Riksmuseum, Stockholm, Sweden (NR, Stockholm); United States National Museum, Washington, D.C., U.S.A. (USNM, Washington); Muséum National d'Histoire Naturelle, Paris, France

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## PRIMITIVE AND DERIVED CHARACTERS

Before attempting to reconstruct the phylogeny of a genus it is necessary to study the different conditions or states of each character and, by comparison with related genera, to determine which is the primitive and which the derived condition in each case. In studies of this kind the character condition found to be most prevalent amongst other genera is assumed to be the primitive condition for the genus under review, whilst the condition more rarely found is assumed to be derived. Certain characters, although variable, show a range of conditions peculiar to the genus under study. In such cases it is necessary, in order to find the primitive state, to search for correlations between these characters and those referred to above. In *Diplocolenus* all components of the male genitalia show variability to a greater or lesser degree and it is these structures together with body colour which have been used in the present study.

XTH SEGMENT (Text-figs 7–25). In the majority of species in the genus the Xth segment is large and globular. A few species, however, such as *bohemani* and *nigrifrons*, have the Xth segment relatively small with the lateral walls parallel. Since a small Xth segment is characteristic of most genera of Jassargini whilst the enlarged condition is found in only *Jassargus*, *Quontus*, *Errastunus*, *Latalus*, *Adarrus*, *Phlebiastes*, *Mogangella*, *Mendreus* and *Mendrausus*, the first five of which appear to be synonymous, the former is suggested as the primitive condition and the enlarged form as the derived state.

CONNECTIVE (Text-figs 65–83). Two character states occur for this structure. In one, seen for example in *frauenfeldi* and *logvinenkoae*, the arms are closely parallel distally and fused over part of their length and in the other, seen for example in *abdominalis* and *evansi*, the arms are widely divergent distally to near apex and then abruptly angled to the midline. The first of these conditions is again the one present in the majority of genera in the tribe and is considered to be primitive whilst the second condition, seen only in *Mongolojassus*, and to a slightly modified extent in *Chelidinus*, *Laevicephalus* and *Yanocephalus*, is derived. This also follows logically from the origin of the Jassargini connective from the typical Y-shaped condition, the subsequent divergence of the arms distally resulting in their abrupt curvature to maintain contact with the aedeagus. An early stage in this development is seen in *tianshanicus*. In *Chelidinus*, *Laevicephalus* and *Yanocephalus* the transverse portion is absent and each arm articulates independently with the aedeagus.

STYLES (Text-figs 65–83). The styles vary in the shape of the apical process from the robust, triangulate form seen in *bohemani* to the acutely elongate form found in *abdominalis*. The first of these conditions is the one present in most genera of Jassargini and is therefore considered to be the primitive state whilst the elongate form, which is rarely found within the tribe outside the present genus, is considered to be derived. The styles also vary in length relative to the connective. The short style seen in *bohemani* and *orientalis* is the prevalent condition amongst other genera of the tribe and is therefore considered to be primitive whilst the long style seen in *abdominalis* and related species is present in only 25% of the genera and is considered to be derived.

AEDEAGUS (Text-figs 84–138). The basal apodeme varies considerably in shape, being either small and narrow as in *bohemani* and *nigrifrons*, short with long laterally extending arms as in *limbatellus* or long and narrow as in *abdominalis*. The first of these three conditions is the one most commonly found amongst other genera of the tribe, whilst forms with laterally extending arms occur only in *Pantallus* and *Kazachstanicus* and the long narrow apodeme is found only in certain species of *Araldus*, *Arocephalus*, *Commellus*, *Hebecephalus*, *Henschia*, *Orocastus* and *Sorhoanus*. The *bohemani*-like apodeme is therefore considered to be the primitive condition from which the other two are derived. This conclusion is supported by correlation with other characters. Variation also occurs in the shape of the shaft which is either slender or robust, directed dorsally at the apex or with the latter turned posteriorly and with one or two pairs of apical processes. A review of the other genera in the tribe shows that a slender, dorsally directed shaft is the most commonly occurring condition whilst forms in which the shaft is turned posteriorly at the apex occur in only *Calamotettix*, *Lemellus*, *Turrutus*, *Errastunus* and certain species of *Laevicephalus*, *Mocuellus*, *Mongolojassus*, *Palus*, *Sorhoanus*, *Rosenus*, *Jassargus* and *Adarrus*. Likewise, most genera have only one pair of apical processes or none at all, two pairs occurring in only *Chloothea*, *Mendreus* and certain species of *Sorhoanus* and *Adarrus*. An aedeagus with a slender shaft, directed dorsally at the apex and with only a single pair of apical processes is therefore considered to be the primitive condition for the genus from which the other more specialized conditions have been derived. As in the case of the basal apodeme, this conclusion is supported by correlation with other characters.

PYGOPHORE PROCESS (Text-figs 26–45). The pygophore varies mainly in the presence or absence of a posterior process. No conclusions can be drawn in this instance by comparison with other genera but by correlation with other characters in the genus the presence of a process is seen to be the primitive condition within the genus and its loss as the derived state.

SUBGENITAL PLATES (Text-figs 46–64). The presence of an indentation on the lateral margin of the plates with a dorsally situated tooth at the base of the indentation are two of the diagnostic characters of the genus. Considerable variation occurs, however, in the length of the apical portion of the plates beyond the indentation, from the long finger-like condition seen in *penthopitta* to that of *configuratus*. In the search for the primitive extreme of this character, comparison with related genera is of little value since apart from the monotypic genus *Anareia*, which is otherwise dissimilar, these characters occur in no other genus within the tribe. It is necessary therefore to look for correlations with other characters within the genus for which the primitive condition is known. From such a study it is seen that in those species possessing the more primitive characters, the subgenital plates in general have only a very small or non-existent medial lobe beyond the indentation, whilst in those species with the more specialized characters the medial lobe is much longer. It seems reasonable to assume therefore that in the primitive condition the subgenital plates were short and broadly triangular with a small dorsally situated tooth apically against the lateral margin. Subsequent prolongation of the plates was impeded laterally by the tooth, resulting in the presence of an indentation. The characters of the subgenital plates were the principal ones used by both Ribaut (1952 : 281) and Emeljanov (1966 : 122) in the delimitation of subgenera. The absence of the dorsal tooth in certain species, as claimed by both workers, is seen to be incorrect whilst reliance on the subgenital plates alone without supporting evidence from other characters is seen to be misleading.

COLOUR (Text-figs 1–6). The majority of species in the genus are pale green with only a few stramineous with fuscous markings. The latter type of coloration occurs in the majority of genera within the tribe and is therefore considered to be the most primitive whilst the pale green condition, present in only a few genera, is considered a derived specialization.

## PHYLOGENY

From the foregoing considerations it can be postulated that the ancestral condition for the genus was a form stramineous in colour, with a posterior process on the pygophore, a small parallel-sided Xth segment, subgenital plates without a lateral indentation but terminating posteriorly in a small dorsally situated tooth, a connective with the arms closely parallel distally and fused over part of their length, a short style with its apical process short and robust and with a simple dorsally directed aedeagus terminating in a single pair of processes and with a short narrow basal apodeme.

The form most closely approaching these conditions is that of *bohemani* which differs only in the shape of the subgenital plates. Since its nearest relatives, *configuratus*, *frauenfeldi* and *altaicus*, however, all show the postulated primitive condition of the subgenital plates we can assume that the *bohemani* line became specialized in this one respect.

From the *bohemani*-like ancestor arose a closely similar form (Ancestor 2) in which the basal apodeme of the aedeagus extended laterally and the Xth segment had begun to expand. This stage is represented by *configuratus* and the *frauenfeldi* group of species all of which show only a slight development, if any, of the mesal margin of the subgenital plate. *D. configuratus* differs from the other species of the group by having a much shorter pygophore, a less well developed mesal lobe on the subgenital plates, the basal apodeme less well developed laterally, the arms of the connective much closer together and not reaching the base of the apical process and the aedeagus with much shorter apical processes, all of which suggests its earlier origin from the *frauenfeldi/altaicus* line.

*D. nigrifrons*, although specialized in the shape of its aedeagus, shows many primitive character conditions and undoubtedly arose very early on in the evolution of the genus, probably as a specialized offshoot between Ancestors 1 and 2. It also acquired the green coloration of the more advanced forms, apparently independent of the main line of evolution.

The next major step in the evolution of the genus, leading to Ancestor 3, was the elongation of the shaft of the aedeagus and the curving posteriorly of its apical portion plus the change in body colour from stramineous to pale green. This stage is represented by the two closely related species *alaicus* and *logvinenkoae* both of which still retain the primitive type of apical process to the style but show further development of the mesal margin of the subgenital plate. *D. alaicus* appears to retain the primitive type of basal apodeme to the aedeagus but this is undoubtedly a secondary reduction.

The next step, exemplified by Ancestor 4, was the elongation of the apical process of the style. Ancestor 4 itself gave rise to three main lines. One line lead to *orientalis*, *convenarum*, *limbatellus* and related species and showed little change from the earlier forms apart from the styles. *D. orientalis* shows the least modification of all and is clearly the most primitive form of this line. In the *limbatellus* group itself, comprising *limbatellus*, *kyrilli*, *sichotanus*, *kaszabi* and *bensoni*, the apical processes of the aedeagus became broad and leaf-like with a pair of small spur-like processes developing immediately basad of them. *D. bensoni*, in which the apical processes are still slender, is undoubtedly the primitive form of the group. *D. convenarum* differs from both *orientalis* and the *limbatellus* group in having a straight shaft to the aedeagus and is clearly a specialized line branching off somewhat earlier than the others and close to the *quadrivirgatus* group, which it resembles in the shape of the pygophore. A second line, derived from the first, acquired a second pair of apical processes on the aedeagus. The primitive condition of this line, in which the slender shaft of the aedeagus is retained, is represented by *quadrivirgatus*. The aedeagus subsequently became shortened and robust as seen in *quadricornis*, followed by the partial fusion or loss of the apical processes as seen in *nigricans* and *penthopitta* respectively. The ancestor of these last three species also developed a major extension of the apical lobe of the subgenital plates. The lineage leading to *penthopitta* itself also developed a ventral extension to the atrium and a secondary reduction of the apical process of the style. The third line from Ancestor 4 lead to Ancestor 5, in which the basal apodeme of the aedeagus became long and narrow and the arms of the connective divergent and abruptly angled distally.

Ancestor 5 gave rise to two main lines. One line showed a marked increase in the length of the style relative to the connective, accompanied by a marked divergence of the arms of the connective itself. This line later branched into two, one branch retaining the slender apical processes to the aedeagus and leading to *evansi* and related species and the other, in which the apical processes were reduced, leading to *exsiliatus*, *caucasicus* and *tianshanicus*. The *evansi* line later gave rise to a line, represented by *abdominalis*, *temperei*, *laetitiae*, *rustavelicus* and *monticola*, in which the apical processes became branched and the pygophore process lost. *D. monticola* became further specialized by the secondary reduction of the aedeagal processes. The second main line from Ancestor 5 lead to Ancestor 6, in which an additional pair of processes were developed at the apex of the aedeagus.

The condition present in Ancestor 6, with the additional processes still small, is preserved in the closely related species *intermedius* and *oseticus*. These processes later increased in size to approximate the length of the initial pair, a stage represented by *ciscaucasicus* and *admistus*, followed by the elongation of both pairs with the more lateral ones moving dorsally, as seen in *melichari*.

The sequence of events in the evolution of the genus as outlined above is illustrated in Text-fig. 139.

## ORIGIN AND DISPERSAL

The evolution of the genus is seen to have taken place exclusively within the Palaearctic Region, only two species, *configuratus* and *evansi*, having succeeded in dispersing into the Nearctic Region. The distribution of the various species shows certain correlations with the successive stages of evolution suggesting, in each case, definite centres of radiation.

The more primitive forms, *bohemani*, *nigrifrons* and *frauenfeldi*, are all widely distributed throughout the region with several species, closely related to *frauenfeldi*, having originated in the more eastern parts. One lineage from the *frauenfeldi* stock migrated across the Bering Strait and gave rise to *configuratus*, which spread throughout Canada and the northern half of the United States.

Of the next major phase of evolution, although the primitive members *alaicus* and *logvinenkoae* are found only in the south central area of the U.S.S.R., the greater part of the development and radiation occurred in the western part of the region where the present day representatives are found. Only the *limbatellus* group appears to have successfully dispersed beyond the area and extended its range across the entire Palaearctic Region.

In contrast, the next and final phase of evolution occurred mainly in the more central and eastern parts of the region, the most highly specialized forms of all, the descendents of Ancestor 6, having evolved exclusively in Caucasia. Only the widely distributed *abdominalis*, and its closely related European species *temperei*, *laetitiae*, *rustavelicus* and *monticola*, occur in the western part of the region and only one species, *evansi*, has dispersed across the Bering Strait into the New World.

The dispersal of *configuratus* and *evansi* into the Nearctic Region clearly occurred on two separate occasions. *D. configuratus*, which is sufficiently distinct from its nearest Palaearctic relatives to be considered a separate species, must have dispersed at a much earlier period than *evansi* which, despite its widespread occurrence throughout the northern part of the Nearctic Region, is still morphologically unchanged from the eastern Palaearctic members of the species. These findings and conclusions are in line with the more primitive status and earlier origin of *configuratus*. The close morphological similarity of both forms to their Palaearctic relatives, however, and the absence of speciation within the New World suggests that both dispersals occurred in relatively recent times.

## ***DIPLOCOLENUS*** Ribaut

*Diplocolenus* Ribaut, 1946 : 82. Type-species: *Deltocephalus calceolatus* Boheman, by original designation.

Small species, 3–5 mm in length, pale green in colour with face, legs and venter dark brown, sometimes cream or stramineous with dark brown markings.

Head wider than pronotum; vertex $1\frac{1}{2}$–2 times longer medially than next eyes with anterior margin angularly rounded, slightly shorter medially than basal width between eyes, anterior margin shagreen and narrowly rounded to face, disc flat and glabrous; clypeus broad, shagreen; trans-clypeal suture distinct; clypellus broad with sides converging slightly to apex; gena next clypellus broad, approximating width of ocellocular area; ocelli very small, separated from eyes by distance 2–3 times own diameter. Pronotum slightly shorter than vertex, lateral margins short, posterior margin shallowly concave. Fore wings long, appendix narrow, inner subapical cell closed, middle subapical cell slightly constricted, outer subapical cell elongate, slightly shorter than inner subapical. Tibia I with setal formula 2.2.2.1.

Male genitalia with pygophore robust, as wide as long or slightly longer or shorter than wide, emarginate dorsally to near midlength, tapering posteriorly and terminating usually in a short ventrally or posteriorly directed process, setae restricted to dorsal margin of lateral wall, with a large or small membranous or semi-membranous lobe-like expansion from latter in most species; Xth segment enlarged, globular with sides convex, sometimes narrow with sides parallel or divergent towards base, rarely attaining or exceeding apex of pygophore, sclerotised dorsally and laterally and usually also ventrally along posterior margin, without basal processes; subgenital plates triangulate, with deep incision laterally, the apex beyond incision finger-like and variable in length, a tooth on dorsal surface at base of incision, setae along ventrolateral margin and sometimes on ventral surface of finger-like apex, multiseriate or uniseriate, plates attaining or not attaining apex of pygophore, rarely exceeding; styles with apical process robust and triangulate or acutely elongate and curving laterally, with single row of teeth or undulations along posteroventral edge, lateral lobe well developed, rarely small, basal process long; connective large, length equal to or less than styles, rarely longer, arms convergent or closely parallel distally and fused over part of length or widely separated and divergent to near apex and then angled abruptly to midline; aedeagus with shaft elongate, rarely short and robust, directed dorsally and usually turned posteriorly at apex, terminating in one or two pairs of apical processes, rarely one pair plus medial process, processes rarely fused, basal apodeme small and short or with dorsolateral corners produced laterally or long and narrow, gonopore apical or subapical.

DIAGNOSIS. The genus is readily distinguished from all other genera of Deltocephalinae, except *Anareia* Vilbaste, by the shape of the subgenital plates in the male. Although *Diplocolenus* and *Anareia* are similar in this respect they differ in the shape of the male pygophore.

DISTRIBUTION. The genus at the present day is distributed throughout the Palaearctic Region from Great Britain in the west to Japan in the east. It also extends from Scandinavia and northern Russia in the north to North Africa in the south. Although a few species occur throughout the major part of this range the majority are restricted to relatively small areas. Only two species have dispersed beyond the region into the northern part of the Nearctic Region.

## Subgenera

Although the genus is clearly monophyletic in origin and its evolution follows an orderly sequence of events, there are three well defined groups coinciding with significant changes in structure. The first and most primitive group has the shaft and apical processes of the aedeagus directed dorsally, the second has the shaft elongated and turned posteriorly at the apex and the third and most advanced group has, in addition, the arms of the connective divergent and abruptly angled distally. In order to draw attention to these three subdivisions each is accorded subgeneric rank, the first two being paraphyletic and the last holophyletic in the sense of Ashlock (1971).

## Subgenus ***DIPLOCOLENUS*** Ribaut

*Diplocolenus* subgenus *Diplocolenus* Ribaut, 1946 : 82. Type-species: *Deltocephalus calceolatus* Boheman, by original designation.

*Diplocolenus* subgenus *Verdanulus* Emeljanov, 1966 : 122. Type-species: *Jassus nigrifrons* Kirschbaum, by original designation. **Syn. n**

Stramineous in colour, sometimes marked with dark brown, rarely pale green with face, legs and venter dark brown to black.

Male genitalia with pygophore terminating posteriorly in a short posteriorly or posteroventrally directed process; Xth segment small with sides parallel or enlarged and increasing in width towards base, apex basad or distad of apex of pygophore; subgenital plates with fingerlike apex variable in length, attaining or exceeding apex of pygophore; styles with apical process robust and triangulate; connective with arms closely parallel distally and fused over part of length; aedeagus with shaft directed dorsally, a pair of apical processes directed dorsally in line with shaft and curving anteriorly at apex, basal apodeme short and narrow or with dorsolateral corners strongly produced laterally.

Included species: *bohemani* (Zetterstedt), *configuratus* (Uhler), *frauenfeldi* (Fieber), *fraternellus* (Baker), *tripartitus* (Kusnezov), *altaicus* Vilbaste, *ikumai* (Matsumura), *nigrifrons* (Kirschbaum).

## Subgenus ***ERDIANUS*** Ribaut

*Diplocolenus* subgenus *Erdianus* Ribaut, 1952 : 281. Type-species: *Acocephalus sudeticus* Kolenati, by original designation.

*Diplocolenus* subgenus *Sabelanus* Ribaut, 1959 : 404. Type-species: *Deltocephalus nasti* Wagner, by original designation. **Syn. n.**

*Diplocolenus* subgenus *Gelidanus* Emeljanov, 1966 : 122. Type-species: *Cicada limbatella* Zetterstedt, by original designation. **Syn. n.**

Pale green, rarely marked with dark brown, face, venter and legs dark brown or black.

Male genitalia with pygophore terminating posteriorly in a short ventrally, posteriorly or ventroposteriorly directed process; Xth segment enlarged, globular, with sides strongly convex, apex basad or distad of apex of pygophore; subgenital plates with finger-like apex variable in length, shorter or longer than pygophore; styles with apical process acutely elongate, curving posterolaterally, rarely short and triangulate; connective with arms closely parallel distally and fused over part of length; aedeagus with shaft elongate, directed dorsally with apex turned posteriorly, rarely straight and directed dorsoposteriorly or short and robust, with one or two pairs of apical processes, the latter rarely fused, basal apodeme short with dorsolateral corners strongly produced laterally, atrium rarely produced ventrally.

Included species: *alaicus* Emeljanov, *logvinenkoae* Emeljanov, *orientalis* (Ribaut), *limbatellus* (Zetterstedt), *sichotanus* Anufriev, *kyrilli* Emeljanov, *kaszabi* Dlabola, *bensoni* (China), *convenarum* (Ribaut), *quadrivirgatus* (Horvath), *quadricornis* Ribaut, *penthopitta* (Walker), *nigricans* (Kirschbaum).

## Subgenus ***VERDANUS*** Oman

*Verdanus* Oman, 1949 : 165. Type-species: *Deltocephalus evansi* Ashmead, by original designation.

Pale green with face, venter and legs dark brown or black.

Male genitalia with pygophore with or without a short ventrally directed process posteriorly; Xth segment enlarged, globular, with sides strongly convex, not exceeding apex of pygophore; subgenital plates with finger-like apex slightly variable in length, shorter than pygophore; styles with apical process acutely elongate, curving posterolaterally; connective with arms divergent distally and abruptly angled to midline; aedeagus with shaft elongate, directed dorsally with apex turned posteriorly, with one or two pairs of apical processes, basal apodeme long and narrow.

Included species: *evansi* (Ashmead), *abdominalis* (Fabricius), *temperei* Ribaut, *laetitiae* Servadei, *rustavelicus* Logvinenko, *monticola* Linnavuori, *exsiliatus* Emeljanov, *caucasicus* Emeljanov, *tianshanicus* Emeljanov, *intermedius* Emeljanov, *oseticus* Emeljanov, *ciscaucasicus* Emeljanov, *admistus* Logvinenko, *melichari* Dlabola.

### KEY TO SUBGENERA

1 Aedeagus with shaft directed dorsally, not turned posteriorly at apex, apical processes parallel and directed dorsally in line with shaft, with apex curving anteriorly, never posteriorly, basal apodeme small or strongly produced laterally; styles with apical process robust, triangulate; connective with arms parallel distally and fused over part of length . . . . . . . ***DIPLOCOLENUS***

– Aedeagus with shaft directed dorsally with apex turned posteriorly, rarely straight and directed dorsoposteriorly, apical processes divergent, sometimes parallel, rarely fused, variously directed at angle to shaft, basal apodeme strongly produced laterally or long and narrow; styles with apical process acutely elongate, rarely short, curving laterally; connective with arms parallel distally and fused over part of length or divergent distally and abruptly angled to midline . . . . 2

2 Aedeagus with basal apodeme strongly produced laterally; connective with arms parallel distally and fused over part of length . . . ***ERDIANUS***

– Aedeagus with basal apodeme long and narrow; connective with arms divergent distally and abruptly angled to midline . . . . ***VERDANUS***

The subgenera proposed above are similar to those suggested by Ribaut (1952 : 281) although the actual grouping of the species differs. He separated *Erdianus* and *Verdanus* on the ventral prolongation of the atrium, which has been shown above to be a highly specialized character of no significance to the main evolutionary trends, and consequently placed *convenarum*, *orientalis* and *obenbergeri* (=*bensoni*) in *Verdanus* rather than *Erdianus* where they belong. The subgenus *Sabelanus* proposed later by Ribaut (1959 : 404) to include those species, *nasti* (=*quadrivirgatus*) and *quadricornis*, with two pairs of apical processes on the aedeagus is clearly an unnatural group. Both species, as shown above, are simply more primitive forms of the *penthopitta* line and also belong to *Erdianus* of which *sudeticus* (=*penthopitta*) is the type-species.

Emeljanov (1966 : 122), using principally the characters of the subgenital plates, suggested a finer division of the genus than that proposed herein and described subgenera for both the *limbatellus* group and *nigrifrons*. His remaining subgenera, however, with the exception of *Calidanus* which belongs to the genus *Anareia*, are as proposed above but being based solely on characters of the subgenital plates contain erroneous groups of species. *D. alaicus*, *logvinenkoae*, *nasti* (=*quadrivirgatus*), *orientalis* and *convenarum* are all included in *Verdanus* rather than *Erdianus* where they belong.

## Key to Species

The key is to males only and is based mainly on the genitalia. Females can be identified only by association with the males.

Males of *fraternellus* are not known and this species is not included in the key. According to Vilbaste (1969 : 2) it is closely related to *frauenfeldi* or *tripartitus*. *D. ikumai* is also omitted since specimens were not available for the present study and the description given by Vilbaste (1969 : 3) makes it difficult to distinguish with certainty from the closely related species *frauenfeldi* and *altaicus*.

1 Aedeagus with shaft not turned posteriorly at apex, terminating in two parallel processes directed dorsally in line with shaft, their apices turned slightly anteriorly, never posteriorly, basal apodeme small or strongly produced laterally (Text-figs 84–93); styles with apical processes robust, triangulate (Text-fig. 69); connective with arms parallel distally and fused over part of length (Text-fig. 68); colour cream or stramineous usually with fuscous markings, if pale green then Xth segment small with sides parallel (Text-fig. 11) . . . . . . . . . . . 2

– Aedagus with shaft turned posteriorly at apex (Text-fig. 94), rarely straight and then with apical process of styles elongate and acute (Text-fig. 76), shaft terminating in two, three or four divergent processes, sometimes parallel, rarely fused, variously directed at angle to shaft but never in line with latter, basal apodeme strongly produced laterally (Text-fig. 99) or long and narrow (Text-fig. 120); styles with apical process elongate and acute (Text-fig. 74), rarely short; connective with arms parallel distally and fused over part of length (Text-fig. 72) or divergent and abruptly angled to midline (Text-fig. 80); colour pale green, rarely extensively marked with dark brown . . . 7

2 (1) Subgenital plates with finger-like apex approximately 2½ times its basal width, exceeding length of plate basad of incision (Text-fig. 46) . ***bohemani*** (p. 373)

– Subgenital plates with finger-like apex wider than long (Text-fig 48) or absent (Text-fig. 47), much shorter than length of plate basad of incision . . 3

3 (2) Subgenital plates with finger-like apex absent, obliquely truncate apically towards midline and base (Text-fig. 47) . . . . ***configuratus*** (p. 374)

– Subgenital plates with finger-like apex present, sometimes very small but apex never obliquely truncate (Text-figs 48–50) . . . 4

4 (3) Colour pale green with apex of fore wings fuscous . . ***nigrifrons*** (p. 378)

– Colour stramineous or cream, marked with dark brown . . . 5

5 (4) Fore wings with broad transverse yellow band near mid-length ***tripartitus*** (p. 376)

– Fore wings without broad transverse yellow band near mid-length . . 6

6 (5) Pygophore process directed ventroposteriorly, not reaching level of ventral margin of pygophore, ventral margin of pygophore immediately basad of process broadly rounded (Text-fig. 28); subgenital plates not reaching apex of pygophore, finger-like apex extending distad of dorsal tooth (Text-fig. 48). ***frauenfeldi*** (p. 375)

– Pygophore process directed ventrally, extending ventrad of ventral margin of pygophore, ventral margin of pygophore immediately basad of process flat (Text-fig. 29); subgenital plates reaching apex of pygophore, finger-like apex not extending distad of dorsal tooth (Text-fig. 49) . . ***altaicus*** (p. 376)

7 (1) Aedeagus with basal apodeme short and strongly produced laterally (Text-fig. 97) or with apical process of style short and triangulate (Text-fig. 71), aedeagus sometimes short and robust (Text-figs 114 & 116); connective with arms parallel distally and fused along part of length (Text-fig. 77) . . 8

– Aedeagus with basal apodeme long and narrow (Text-fig. 120), aedeagus and apical process of style always elongate (Text-figs 79 & 119); connective with arms divergent distally and abruptly angled to midline (Text-fig. 80) . 20

8 (7) Aedeagus elongate, with one pair of apical processes directed dorsally or anteriorly (Text-fig. 94), a pair of lateral subapical spur-like processes sometimes present (Text-fig. 103) . . . 9

– Aedeagus elongate or robust, with one or two pairs of apical processes or with apex expanded into broad umbrella-like plate (Text-fig. 116), if one pair of apical processes then aedeagus robust and processes directed ventrally (Text-fig. 114), subapical spur-like processes never present . . . 17

9 (8) Aedeagus with shaft straight (Text-fig. 100) . . . . ***convenarum*** (p. 383)

– Aedeagus with shaft turned posteriorly at apex (Text-fig. 98) . . . 10

10 (9) Pygophore with posterior processes short and robust, arising from extreme posteroventral corner and directed ventrally (Text-fig. 32) or posteriorly (Text-fig. 34), sometimes vestigial; apical processes of aedeagus slender (Text-fig. 97) or elongate and leaf-like (Text-fig. 103) . . . 11

– Pygophore with posterior processes short and slender, arising from posterior margin and directed posteroventrally (Text-fig. 33); apical processes of aedeagus short and triangulate (Text-fig. 99) . . . ***orientalis*** (p. 379)

11 (10) Pygophore processes directed posteriorly or vestigial; aedeagus with a pair of lateral subapical spur-like processes immediately basad of apical processes (Text-fig. 103) . . . . . . . . . . . 12

– Pygophore processes directed ventrally; aedeagus without subapical spur-like processes (Text-fig. 97) . . . . . . . . . . . . 16

12 (11) Aedeagus with apical processes slender (Text-fig. 110); pygophore processes vestigial . . . . . . . . . . ***bensoni*** (p. 382)

– Aedeagus with apical processes broad and leaf-like (Text-fig. 106); pygophore processes short and robust . . . . . . . . . 13

13 (12) Aedeagus with apical processes broadly cleft apically (Text-fig. 109). ***kaszabi*** (p. 382)

– Aedeagus with apical processes narrowly acute apically (Text-fig. 102) . . 14

14 (13) Aedeagus with apical processes diametrically opposite each other, directed laterally and curving anteriorly, subapical processes directed ventrally, shaft relatively broad (Text-figs 106 & 107) . . . . ***sichotanus***[1] (p. 381)

– Aedeagus with apical processes less divergent, not diametrically opposite, directed laterally and curving dorsally (Text-fig. 104) or anterodorsally (Text-fig. 102), subapical processes directed laterally or dorsally, shaft relatively narrow . . . . . . . . . . . . 15

15 (14) Aedeagus with apical processes curving anterodorsally, subapical processes directed laterally, shaft with sides straight (Text-figs 102 & 103). ***limbatellus***[1] (p. 380)

– Aedeagus with apical processes curving dorsally, subapical processes directed dorsally, shaft with sides slightly convex near midlength (Text-figs 104 & 105) . . . . . . . . . . . ***kyrilli***[1] (p. 381)

16 (11) Aedeagus with shaft slender, apical processes directed dorsally, basal apodeme plate-like with dorsolateral corners produced dorsolaterally (Text-figs 94 & 95) . . . . . . . . . . . ***alaicus*** (p. 378)

– Aedeagus with shaft broad, apical processes directed anteriorly, basal apodeme V-shaped (Text-figs 96 & 97) . . . . . ***logvinenkoae*** (p. 379)

17 (8) Aedeagus with two pairs of apical processes . . . . . . . 18

– Aedeagus with one pair of apical processes or with apex expanded into broad umbrella-like plate . . . . . . . . . . 19

18 (17) Aedeagus with shaft short, robust and straight, apical processes robust, the dorsal pair approximately half length of ventral pair . ***quadricornis*** (p. 385)

– Aedeagus with shaft slender with apex turned posteriorly, apical processes slender, the dorsal and ventral pair of equal length (Text-figs 112 & 113). ***quadrivirgatus*** (p. 384)

19 (17) Aedeagus with a pair of short, ventrally directed, apical processes (Text-figs 114 & 115) . . . . . . . . . ***penthopitta*** (p. 386)

– Aedeagus with apex expanded into broad, anteriorly incised, umbrella-like plate (Text-figs 116–118) . . . . . . . ***nigricans*** (p. 385)

20 (7) Aedeagus with one pair of apical processes, branched or unbranched (Text-figs 120 & 122), rarely with additional unpaired medial process apically (Text-figs 129 & 130) . . . . . . . . . . . . 21

– Aedeagus with two pairs of apical processes (Text-figs 131 & 132), never branched, sometimes fused basally (Text-figs 135 & 136), additional medial process never present . . . . . . . . . . . 29

21 (20) Aedeagus with apical processes unbranched . . . . . . . 22

– Aedeagus with apical processes branched . . . . . . . . 25

22 (21) Aedeagus with paired apical processes long and slender (Text-fig. 120). ***evansi*** (p. 387)

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[1] These three species are very closely related and may in fact be the same species. The differences referred to in the above key are slight and intermediate forms may be found.

– Aedeagus with paired apical processes small and triangulate (Text-fig. 128) . 23

23 (22) Aedeagus with additional unpaired medial process apically (Text-figs 129 & 130). ***tianshanicus*** (p. 391)

– Aedeagus without additional unpaired process apically . . . . . 24

24 (23) Aedeagus with shaft directed dorsally with apical half turned posteriorly (Text-fig. 127) . . . . . . . . . ***exsiliatus*** (p. 390)

– Aedeagus with shaft directed dorsally with slight anteriorly directed kink at midlength, apical half not turned posteriorly . . . ***caucasicus***[2] (p. 391)

25 (21) Aedeagus with apical processes long and slender, portions basad and distad of branching of approximately equal width (Text-fig. 122) . . . . . 26

– Aedeagus with apical processes short and robust, portion basad of branching approximately twice width of distal portion (Text-figs 125 & 126). ***monticola*** (p. 390)

26 (25) Aedeagus with dorsal and ventral branches of apical processes of approximately equal length (Text-fig. 121) . . . . . . . . . . 27

– Aedeagus with dorsal branch of apical processes approximately half length of ventral branch (Text-fig. 123) . . . . . . . . . 28

27 (26) Aedeagus with dorsal and ventral branches of apical processes at approximately right angles to each other, the dorsal branch directed anteriorly and the ventral branch directed ventrally (Text-figs 121 & 122) . ***abdominalis*** (p. 388)

– Aedeagus with dorsal and ventral branches of apical processes in an approximately straight line, the dorsal branch directed dorsally and the ventral branch directed ventrally . . . . . . . ***temperei*** (p. 389)

28 (26) Aedeagus with distal half of shaft much thicker in lateral aspect than basal half, shaft in posterior aspect tapering gradually to apex (Text-figs 123 & 124). ***laetitiae*** (p. 389)

– Aedeagus with shaft of uniform width in lateral aspect, shaft in posterior aspect with slight enlargement on each side near midlength. ***rustavelicus***[3] (p. 390)

29 (20) Aedeagus with medial, more posterior, pair of apical processes much shorter than lateral, more basad pair (Text-figs 131 & 132) . . . . . . 30

– Aedeagus with two pairs of apical processes of approximately equal length (Text-figs 135 & 138) . . . . . . . . . . . . 31

30 (29) Aedeagus with medial, more posterior, pair of apical processes very short, their length equal to or only slightly greater than their basal width (Text-fig. 134). ***oseticus*** (p. 392)

– Aedeagus with medial, more posterior, pair of apical processes longer, their length approximately three times their basal width (Text-fig. 132). ***intermedius*** (p. 392)

31 (29) Aedeagus with medial, more posterior, pair of apical processes triangulate, each fused to adjacent more lateral process over basal half, the more lateral pair of processes directed ventrolaterally (Text-figs 135 & 136) . . . . 32

– Aedeagus with both pairs of apical processes slender and independent of each other, the more lateral pair of processes directed dorsolaterally and curving ventrolaterally (Text-figs 137 & 138) . . . . . ***melichari*** (p. 394)

32 (31) Aedeagus with medial, more posterior, pair of apical processes fused to each other over their basal half, basal apodeme with small denticle on each lateral margin . . . . . . . . . . ***admistus*** (p. 393)

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[2] Specimens of *caucasicus* were not available for study and the differences referred to in the above key between this species and *exsiliatus* are based on illustrations given by Emeljanov (1962 : 179, figs 90–91).

[3] Specimens of *rustavelicus* were not available for study and the differences referred to in the above key between this species and *laetitiae* are based on illustrations given by Logvinenko (1971 : 591, fig. 2).

– Aedeagus with medial, more posterior, pair of apical processes not fused to each other over their basal half, basal apodeme without small denticles (Text-figs 135 & 136) . . . . . . . . ***ciscaucasicus*** (p. 393)

## Description of Species

### ***Diplocolenus*** (***Diplocolenus***) ***bohemani*** (Zetterstedt)

(Text-figs 1, 2, 7, 26, 46, 65, 84 & 85)

*Cicada bohemani* Zetterstedt, 1840 : 290. LECTOTYPE ♂, NORWAY: Dovre [not Vaage as stated by Zetterstedt] (*Boheman*) (UZI, Lund), here designated [examined].

*Deltocephalus calceolatus* Boheman, 1847 : 23. LECTOTYPE ♂, SWEDEN: Uppland (*Boheman*) (NR, Stockholm), here designated [examined].

*Deltocephalus tiaratus* Fieber, 1869 : 204. LECTOTYPE ♂, no data (MNHN, Paris), here designated [examined]. **Syn. n.**

Length: ♂ 3·7–4·1 mm (mean 3·9 mm); ♀ 4·3–4·6 mm (mean 4·4 mm).

Colour of vertex pale brown with midline and anterior and lateral margins cream, a narrow dark brown line extending along anterior margin on each side between apex and eye; face stramineous, clypeus brown, with a parallel series of transverse lines on each side of midline cream; pronotum pale brown with midline and two longitudinal lines on each side cream; fore wings stramineous, veins whitish bordered with dark brown, apical margin dark brown; legs and venter stramineous marked with brown; whole body sometimes pale stramineous without markings.

Male genitalia with pygophore slightly longer than wide, terminating posteroventrally in a short slender ventrally directed process, membranous expansion from dorsal margin very narrow; Xth segment with sides slightly divergent towards base, not reaching apex of pygophore, sclerotized ventrally along posterior margin; subgenital plates with length of finger-like apex approximately 2½ times its basal width and exceeding length of part basad of incision, a multiseriate row of setae along its ventral surface, lateral row of setae uniseriate, plates exceeding apex of pygophore; styles with apical process short, robust, lateral lobe well developed; connective longer than styles, arms parallel distally and fused over one third total length; aedeagus with shaft short, slender, turned dorsad near midlength and terminating in a pair of long slender dorsally directed processes curving anterodorsally at their midlength, basal apodeme short with dorsolateral corners produced slightly dorsolaterally.

DISTRIBUTION. Scandinavia, Europe, North Africa and U.S.S.R.

MATERIAL STUDIED.

Lectotype ♂ and paralectotypes of *Cicada bohemani* Zetterstedt (UZI, Lund); lectotype ♂ and paralectotypes of *Deltocephalus calceolatus* Boheman (NR, Stockholm); lectotype ♂ and paralectotypes of *Deltocephalus tiaratus* Fieber (MNHN, Paris).

ITALY: 1 ♂, Molveno, –.viii.1931 (*Grey*) (BMNH). AUSTRIA: 1 ♂, 2 ♀, Tyrol, Landeck, –.vi.1957 (*Day & Ward*) (BMNH); 1 ♂, 1 ♀, Carinthia, Raibl (*Eger*) (BMNH). CZECHOSLOVAKIA: 2 ♀, Moravia (*Eger*) (BMNH). BULGARIA: 2 ♂, m. Rila, 8–12.viii.1939 (*Lindberg*) (BMNH). FINLAND: 1 ♂, Suomi EH Lammi, 20.vi.1958 (*Linnavuori*) (BMNH); 1 ♂, Suomi St. Säkylä, 21.vi.1948 (*Linnavuori*) (LC, Raisio).

The type-series of *Cicada bohemani* Zetterstedt, deposited in the UZI, Lund, consists of one male labelled 'C. Bohemanni. ♂. Dovre' and two males and two females without data, all of which were examined. The labelled male is here designated as lectotype and the other four specimens as paralectotypes.

The type-series of *Deltocephalus calceolatus* Boheman, deposited in the NR, Stockholm, and consisting of three males and four females labelled 'Upl.' and 'Bhn' and one female labelled 'Nv. alp.' and 'Bhn', was examined. In the original description Boheman (1847 : 23) gives the data of the syntypes as 'Tollare in Wermdön d.28 Junii 1846' and 'Westrogothia et Norvegia alpina'. A male is here designated as lectotype and the other seven specimens as paralectotypes.

The type-series of *Deltocephalus tiaratus* Fieber, deposited in the MNHN, Paris, consists of one male without data, one female labelled 'Bamberg', one female labelled 'Lautaret', one female labelled 'Srkoutsk' and one specimen with the apex of the abdomen missing and without data. All these specimens were examined and the male is here designated as lectotype and the others as paralectotypes.

*Deltocephalus calceolatus* was originally included in *Diplocolenus* by Ribaut (1946 : 82) and designated as the type-species. It had been synonymized earlier with *bohemani* by Puton (1874 : 229) and considered by subsequent workers as a subspecies. Ribaut, however, did not mention *bohemani* in his new genus and it was Ossiannilsson (1947 : 153) who first transferred *bohemani* to *Diplocolenus*. *Deltocephalus tiaratus* was first transferred to *Diplocolenus* by Ribaut (1952 : 284).

This species is the most primitive member of the genus and occurs throughout the Palaearctic Region.

### ***Diplocolenus* (*Diplocolenus*) *configuratus* (Uhler)**

(Text-figs 8, 27, 47, 70, 86 & 87)

*Deltocephalus configuratus* Uhler, 1878 : 511. LECTOTYPE ♂, U.S.A.: Montana, Milk River, 1873–74 (*Coues*) (USNM, Washington), here designated [examined].

Length: ♂ 3·3–3·8 mm (mean 3·5 mm); ♀ 3·7–4·3 mm (mean 3·9 mm).

Colour as in *frauenfeldi*.

Male genitalia with pygophore wider than long, terminating posteroventrally in a short posteriorly directed process, a narrow membranous expansion from dorsal margin; Xth segment with sides strongly divergent towards base, exceeding apex of pygophore, sclerotized over major part of ventral surface; subgenital plates with apex obliquely truncate towards midline and base, the medial margin approximately one third length of lateral margin, latter terminating in a dorsally directed tooth, a short row of setae ventrally on medial margin, lateral row of setae multiseriate, plates exceeding apex of pygophore; styles with apical process robust, triangulate, lateral lobe small; connective shorter than styles, arms parallel distally and fused over only short part of length; aedeagus with shaft short, slender, directed dorsoposteriorly and terminating in a pair of short, parallel, dorsally directed processes, basal apodeme short with dorsolateral corners produced dorsolaterally.

DISTRIBUTION. Canada and northern U.S.A.

MATERIAL STUDIED.

Lectotype ♂ of *Deltocephalus configuratus* Uhler (USNM, Washington).

CANADA: 1 ♂, Saskatchewan, Saskatoon, 13.vi.1949 (*Brooks*); 2 ♂, 1 ♀, Quebec, Hudson Heights, 24–30.vii.1956 (*Lindberg*); 1 ♀, Quebec, Hudson Heights, 25–31.viii.1956 (*Lindberg*); 1 ♂, Labrador, Hopedale, 8.viii.1926 (*Perrett*). U.S.A.: 1 ♂, Pennsylvania, Charter Oak, 18.vi.1918 (*Knull*); 1 ♂, Pennsylvania, Charter Oak, 18.vi.1918 (*Kirk*); 1 ♀, Pennsylvania, Harrisburg, 8.vii.1917 (*Sanders*); 21 ♂, 6 ♀, New Hampshire, Peterborough, 10.vi.1959 (*Zimmerman*); 1 ♀, Colorado, Walden, 20.viii.1931 (*Beamer*); 1 ♀, Utah, Duchesne Co., Indian Canyon, 15.vii.1964 (*Knowlton*); 1 ♂, Utah, Castle Dale, 17.vii.1964 (*Knowlton*). All in BMNH.

The type-series of this species deposited in the USNM, Washington, consists of one male, two females and one specimen without an abdomen.[4] The male alone was examined and is here designated as lectotype.

This species was transferred to *Diplocolenus* by Oman (1949 : 166) and is the only species of the genus endemic to the Nearctic Region. It is undoubtedly an early offshoot of the *frauenfeldi*/*altaicus* line.

### ***Diplocolenus*** (***Diplocolenus***) ***frauenfeldi*** (Fieber)

(Text-figs 3, 4, 9, 28, 48, 69, 88 & 89)

*Deltocephalus frauenfeldi* Fieber, 1869 : 206. LECTOTYPE ♂, AUSTRIA, no further data (MNHN, Paris), here designated [examined].

Length ♂ 3·2–3·5 mm (mean 3·3 mm); ♀ 3·8–4·1 mm (mean 3·9 mm).

Colour of vertex cream with two triangular patches at apex, a patch on disc on each side of midline and two smaller patches on posterior margin brown; face stramineous or cream marked with brown, clypeus pale brown with a parallel series of transverse stripes cream; pronotum cream washed with pale brown with small dark brown patches over anterior half, midline and two longitudinal lines on each side sometimes whitish; scutellum cream with medial area brown; fore wings pale stramineous, veins whitish bordered with brown, apical margin brown; venter and legs stramineous.

Male genitalia with pygophore as wide as long, terminating posteroventrally in a short slender ventroposteriorly directed process, without membranous expansion from dorsal margin; Xth segment with sides slightly convex, not reaching apex of pygophore, sclerotized ventrally along posterior margin; subgenital plates with finger-like apex wider than long and with a small group of setae on ventral surface, lateral row of setae multiseriate, plates not reaching apex of pygophore; styles with apical process robust, triangulate, lateral lobe well developed; connective shorter than styles, arms convergent distally and fused over part of length; aedeagus with shaft short, slender, turned dorsad at midlength and terminating in a pair of long slender parallel processes directed dorsally and turning anterodorsally at their midlength, basal apodeme short with dorsolateral corners strongly produced dorsolaterally.

DISTRIBUTION. Europe and southern U.S.S.R.

MATERIAL STUDIED.

Lectotype ♂ and paralectotypes of *Deltocephalus frauenfeldi* Fieber (MNHN, Paris).

U.S.S.R.: 2 ♂, 1 ♀, Siberia, Zalagansk, Charinzovka, 6.vii.1932 (*Zachvatkin*) (BMNH); 4 ♂, 2 ♀, Kurile Islands, Shikotan, 13.viii.1971 (*Petrova*) (GAA, Gorky). AUSTRIA: 2 ♀, Donau-Au (*Eger*) (BMNH); 1 ♂, Leithagebirge, Zeilerberg (*Franz*) (WW, Hamburg); 1 ♀, Bad Vöslau, Nieder-Donau (WW, Hamburg).

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[4] Dr J. P. Kramer, personal communication.

The type-series of *Deltocephalus frauenfeldi* Fieber, deposited in the MNHN, Paris, consists of one male labelled 'Autriche', one male and two females without data and one female labelled 'Embrun', all of which were examined. The male labelled 'Autriche' is here designated as lectotype and the remaining specimens as paralectotypes.

This species was originally included in the genus by Ribaut (1946 : 85).

### ***Diplocolenus* (*Diplocolenus*) *fraternellus*** (Baker)

*Deltocephalus fraternus* Matsumura, 1915 : 166. 3 ♀ syntypes, KOREA: Berg Chohaku (*Ikuma*) (EIHU, Sapporo) [not examined]. [Primary homonym of *Deltocephalus fraternus* Ball, 1911 : 201.]

*Deltocephalus fraternellus* Baker, 1925 : 537. [Replacement name for *Deltocephalus fraternus* Matsumura, 1915.]

Vilbaste (1969 : 2) transferred this species to *Diplocolenus* following examination of the three female syntypes and considered it to be closely related to *frauenfeldi* or *tripartitus*. The male is not known, the figures given by Emeljanov (1966 : 126, figs 95–96) being *Futasujinus candidus* (Matsumura) (Vilbaste, 1967 : 48).

DISTRIBUTION. Korea and Japan.

MATERIAL STUDIED. No specimens were available for the present study.

### ***Diplocolenus* (*Diplocolenus*) *tripartitus*** (Kusnezov)

*Deltocephalus tripartitus* Kusnezov, 1929 : 179. Holotype ♂, U.S.S.R.: Transbaikalia, Troizkosavskij Rayon, River Tschikoi, Scharagol, 1.vii.1928 (*Lukjanovitsh*) (ZI, Leningrad) [not examined].

*Deltocephalus kiritshenkoi* Zachvatkin, 1953 : 248. ♂ ♀ syntypes, MONGOLIA: banks of Lake Kosogol, 3 ♀, Santa Ara on western banks, 30.vii.1903, 1 ♂, 1 ♀, Santa-Tologoy, 28.vii.1903, 1 ♀, banks between rivers Dzhagluik and Khatchim, –.vii.1903 (*Elpat'evski*) (ZM, Moscow) [not examined].

This species is redescribed and the aedeagus illustrated by Dlabola (1965 : 123), who transferred it to *Diplocolenus* and placed *Deltocephalus kiritshenkoi* as its synonym. From the shape of the aedeagus it is closely related to *frauenfeldi* but differs by the possession of a broad transverse yellow band across the middle of the fore wings.

DISTRIBUTION. Mongolia and Transbaikalia, U.S.S.R.

MATERIAL STUDIED. No specimens were available for the present study.

### ***Diplocolenus* (*Diplocolenus*) *altaicus*** Vilbaste **stat. n.**

(Text-figs 10, 29, 49, 68, 90 & 91)

*Diplocolenus frauenfeldi altaicus* Vilbaste, 1965 : 72. Holotype ♂, U.S.S.R.: Altai, Khaisin, 30.vii.1959 [not 1.viii.1959 as stated by Vilbaste] (*Vilbaste*) (IZB, Tartu) [examined].

Length: ♂ 3·20–3·28 mm (mean 3·24 mm).

Colour as in *frauenfeldi* but with venter, legs and basal half of fore wings dark brown.

Male genitalia with pygophore as long as wide, terminating posteroventrally in a slender ventrally directed process, with a very narrow membranous expansion from dorsal margin; Xth segment with sides divergent towards base, not reaching apex of pygophore, sclerotized ventrally along posterior margin; subgenital plates with apex truncate and shallowly concave medially, lateral margin terminating in a small dorsally directed tooth, a group of setae on ventral surface against medial margin, lateral row of setae multiseriate, plates reaching to apex of pygophore; styles with apical process robust and triangulate, lateral lobe well developed; connective shorter than styles, arms convergent distally and fused over one third total length; aedeagus with shaft short, slender, turned dorsally at midlength and terminating in a pair of long, slender, parallel processes, directed dorsally and turning anterodorsally at midlength, basal apodeme short with dorsolateral corners strongly produced dorsolaterally.

DISTRIBUTION. Mongolia and Altayskaya Province, U.S.S.R.

MATERIAL STUDIED.

Holotype ♂ of *Diplocolenus frauenfeldi altaicus* Vilbaste (IZB, Tartu).

U.S.S.R.: 1 ♂, Altayskaya Province, Kurayskiy mountain range, 2.vii.1969 (*Emeljanov*) (BMNH).

This species differs from *frauenfeldi* in colour and in the shape of the subgenital plates and pygophore process. It is here considered sufficiently distinct to be a separate species.

### ***Diplocolenus*** **(*Diplocolenus*)** ***ikumai*** (Matsumura)

*Deltocephalus ikumai* Matsumura, 1911 : 29. 8 syntypes, U.S.S.R.: Sakhalin, Korsakov (*Ikuma*) (EIHU, Sapporo) [not examined].

This species was transferred to *Diplocolenus* by Ishihara (1966 : 39) on the basis of specimens from the Kurile Islands. The illustrations given by Ishihara, however, suggest that the material before him was in fact *frauenfeldi*. Moreover, four male and two female specimens from the Kurile Islands examined in the present study and identical to Ishihara's illustrations also appear to be *frauenfeldi*. Vilbaste (1969 : 3) who studied six female syntypes from Sakhalin, together with a male and six females from the same locality, showed *ikumai* to be a form very similar to *frauenfeldi* but with a relatively shorter pygophore and with the pygophore process directed more ventrally.

DISTRIBUTION. Sakhalin and Primorsk Territory, U.S.S.R.

MATERIAL STUDIED. No specimens were available for the present study.

The close similarity between *frauenfeldi*, *ikumai*, *tripartitus* and *fraternellus* suggests that they may all be the same species, although longer series throughout their respective ranges are required for confirmation. Only *frauenfeldi* in this group is widely distributed throughout the Palaearctic Region, the other species, together with the related species *altaicus*, having restricted distributions in the more eastern parts of the region.

## ***Diplocolenus* (*Diplocolenus*) *nigrifrons*** (Kirschbaum)

(Text-figs 11, 30, 50, 66, 92 and 93)

*Jassus* (*Deltocephalus*) *nigrifrons* Kirschbaum, 1868 : 139. ♀ type(s) [number not stated], AUSTRIA (*Mayr*) (? NM, Wiesbaden) [not examined].

*Deltocephalus ensatus* Then, 1897 : 109. ♂♀ syntypes [number not stated], AUSTRIA: Kärnten, Greifenburg, July & August (? SL, Graz) ( [not examined].

*Diplocolenus parcanicus* Dlabola, 1948 : 6. Holotype ♂, CZECHOSLOVAKIA: Slovakia, Parkán, –.vii.1948 (*Obenberger*) (NM, Prague) [not examined].

Length: ♂ 2·60–3·90 mm (mean 3·30 mm); ♀ 3·60–3·82 mm (mean 3·73 mm).

Colour pale green with apex of apical cells fuscous; face and venter dark brown; legs stramineous marked with dark brown.

Male genitalia with pygophore as long as wide, terminating posteriorly in a long stout ventrally directed blade-like process, with a small membranous expansion from dorsal margin; Xth segment with sides parallel, length approximately 1½ times width, not reaching apex of pygophore, sclerotized ventrally along posterior margin; subgenital plates with apex truncate with shallow medial depression, lateral margin terminating adjacent to depression in a small dorsal tooth, a small number of setae on medial edge of ventral surface immediately basad of apex and with uniseriate row of setae laterally, plates reaching to apex of pygophore; styles with apical process robust, lateral lobe well developed; connective equal in length to styles, arms parallel distally and fused along part of length; aedeagus with shaft short, directed dorsally and terminating in a pair of short anteriorly directed processes, their bases expanded slightly, a pair of short slender anteriorly directed processes sometimes present at apex between larger pair, basal apodeme short with dorsolateral corners produced slightly dorsolaterally.

DISTRIBUTION. Europe, Scandinavia, U.S.S.R. and Japan.

MATERIAL STUDIED.

CZECHOSLOVAKIA: 1 ♂, 2 ♀, Slovakia, Parkán, –.vii.1948 (*Obenberger*) (paratypes of *Diplocolenus parcanicus* Dlabola) (NM, Prague). BULGARIA: 1 ♂, Pancarevo, 15.vii.1956 (*Hoberlandt*) (NM, Prague). U.S.S.R.: 1 ♂, Kazakstan, Akmolinsk Province, Kapetau, 28.v.1957 (*Emeljanov*) (BMNH); 1 ♂, 1 ♀, Ukraine, Askaniya Nova, 30.v.1926 (*Znoiko*) (BMNH).

*Deltocephalus ensatus* was first synonymized with *nigrifrons* by Horvath (1903 : 557). *Deltocephalus nigrifrons* was transferred to *Diplocolenus* by Dlabola (1954 : 75) who in the same work (p. 213) listed *parcanicus* as its synonym for the first time.

This is a widely distributed species retaining many primitive characters yet specialized in colour and in the shape of the aedeagus. It does not appear to be closely related to any other species but undoubtedly arose early in the evolution of the genus.

## ***Diplocolenus* (*Erdianus*) *alaicus*** Emeljanov

(Text-figs 12, 31, 51, 71, 94 and 95)

*Diplocolenus alaicus* Emeljanov, 1966 : 123. Holotype ♂, U.S.S.R.: Tadzhikistan, south slope of Petra I range, Sikat, 13.vi.1963 (*Soboleva*) (ZI, Leningrad) [not examined].

Length: ♂ 4·7 mm.

Colour pale green with apex of apical cells fuscous; face and venter dark brown; legs straminous marked with dark brown.

Male genitalia with pygophore as wide as long, terminating posteroventrally in a short robust ventrally directed process and with a large membranous expansion from dorsal margin; Xth segment with sides convex, exceeding apex of pygophore, sclerotized ventrally on posterior margin; subgenital plates with finger-like apex approximately as long as wide with a short uniseriate row of setae on ventral surface, lateral row of setae multiseriate, plates exceeding apex of pygophore; styles with apical process robust and triangulate, lateral lobe small; connective shorter than styles, arms parallel distally and fused over short distance of length; aedeagus with shaft slender, directed dorsally with apical third turned posteriorly, terminating in a pair of short slender dorsally directed and divergent processes, basal apodeme short and broad, plate-like with dorsolateral corners produced dorsolaterally.

DISTRIBUTION. Tadzhikistan Republic, U.S.S.R.

MATERIAL STUDIED.

U.S.S.R.: 1 ♂, Tadzhikistan, Sikat, south slope of Petra I Range, 13.vi.1963 (*Soboleva*) (paratype of *Diplocolenus alaicus* Emeljanov) (BMNH).

## ***Diplocolenus* (*Erdianus*) *logvinenkoae*** Emeljanov

(Text-figs 13, 32, 52, 67, 96 and 97)

*Diplocolenus logvinenkoae* Emeljanov, 1964 : 432. Syntypes [sex and number not stated], U.S.S.R.: Kazakhstan (ZI, Leningrad, and BMNH) [1 ♂ examined].

Length: ♂ 4·0 mm.
Colour as in *alaicus*.
Male genitalia with pygophore as wide as long, terminating posteroventrally in a short robust ventrally directed process, with a large membranous expansion on dorsal margin; Xth segment with sides strongly convex, exceeding apex of pygophore, not sclerotized ventrally; subgenital plates with finger-like apex approximately as long as wide with several setae on ventral surface, lateral row of setae multiseriate, plates not reaching apex of pygophore; styles with apical process robust and triangulate, lateral lobe small; connective as long as styles, arms parallel distally and fused over short distance of length; aedeagus with shaft elongate, directed dorsally with apical one fourth turned posteriorly, terminating in a pair of short slender anteriorly directed divergent processes, basal apodeme very short with dorsolateral corners strongly produced dorsolaterally.

DISTRIBUTION. Kazakhstan, U.S.S.R.

MATERIAL STUDIED.

U.S.S.R.: 1 ♂, Kazakhstan, Akmolinsk Province, Kokshetau, nr. Tersakkan (*Emeljanov*) (syntype of *Diplocolenus logvinenkoae* Emeljanov, labelled as 'paratype') (BMNH).

## ***Diplocolenus* (*Erdianus*) *orientalis*** (Ribaut)

(Text-figs 14, 33, 53, 74, 98 and 99)

*Deltocephalus orientalis* Ribaut, 1936 : 261. Holotype ♂, FRANCE: Pyrénées-Orientales, Puyvalador (RC, Toulouse) [not examined].

Length: ♂ 4·00–4·10 mm (mean 4·05 mm); ♀ 5·00 mm.
Colour as in *alaicus*.
Male genitalia with pygophore as long as wide and terminating in a short slender ventroposteriorly directed process, without membranous expansion on dorsal margin; Xth segment

with sides strongly divergent towards base, not reaching apex of pygophore, not sclerotized ventrally; subgenital plates with finger-like apex nearly twice as long as wide and with a few setae ventrally, lateral row of setae multiseriate, plates reaching apex of pygophore; styles with apical process slender and curving posterolaterally, lateral lobe well developed; connective shorter than styles, arms convergent distally and fused over short distance of length; aedeagus with shaft elongate, directed dorsally with apical one fourth turned posteriorly and terminating in a pair of short triangulate anteriorly directed processes, basal apodeme very short with dorsolateral corners strongly produced dorsolaterally.

DISTRIBUTION. Southern France.

MATERIAL STUDIED.

FRANCE: 1 ♂, Ariège, Saint Béat (*Ribaut*) (paratype of *Deltocephalus orientalis* Ribaut) (BMNH); 1 ♂, Ariège, Quérigut, 19.vii.1936 (*Ribaut*) (WW, Hamburg); 1 ♀, Pyrénées Orientales, Canigou, 2.viii.1957 (*Gravostein*) (WW, Hamburg).

This species was originally included in *Diplocolenus* by Ribaut (1946 : 85).

## ***Diplocolenus* (*Erdianus*) *limbatellus*** (Zetterstedt)

(Text-figs 15, 34, 54, 77, 102 & 103)

*Cicada abdominalis limbatella* Zetterstedt, 1828 : 522. LECTOTYPE ♂, SWEDEN: Lapland, 27.vii.– (UZI, Lund), here designated [examined].

Length: ♂ 3·4–3·9 mm (mean 3·8 mm); ♀ 3·5–3·7 mm (mean 3·6 mm).

Colour pale green, with or without fuscous markings, apices of apical cells fuscous; face and venter dark brown; legs stramineous marked with dark brown.

Male genitalia with pygophore wider than long, terminating posteroventrally in a short robust posteriorly directed process, with a narrow membranous expansion on dorsal margin; Xth segment globular with sides strongly convex, not reaching apex of pygophore, sclerotized ventrally along posterior margin; subgenital plates with finger-like apex short, approximately as long as wide and with a few setae on ventral surface, lateral row of setae uniseriate, plates not reaching apex of pygophore; styles with apical process slender, curving laterally, lateral lobe well developed; connective as long as styles, arms parallel distally and fused over short distance of length; aedeagus with shaft elongate, directed dorsally with apical third turned posteriorly, terminating in a pair of broad leaf-like and apically attenuated processes directed laterally and curving dorso-anteriorly, a pair of much smaller triangular processes laterally immediately basad of apical pair and directed laterally, basal apodeme very short with dorsolateral corners strongly produced laterally.

DISTRIBUTION. Scandinavia and northern U.S.S.R.

MATERIAL STUDIED.

Lectotype ♂ and paralectotype ♂ of *Cicada abdominalis limbatella* Zetterstedt (UZI, Lund).

SWEDEN: 2 ♂, 1 ♀, L. Tjultrask, 16°5′E. 66°N., 29.viii.1962; 3 ♂, Lapland, south of Riksgransen below Satnjarastjarro, 900–1000 m, 19.vii.1957 (*Gardiner*); 1 ♀, Lapland, south of Riksgransen, slopes of Jarpa-Karpel, 900–1000 m, 21.vii.1957 (*Gardiner*); 2 ♂, Pite Lappm., Vuoggatjalme, 9.viii.1933 (*Ossiannilsson*); 1 ♀, Pite Lappm., Vuoggatjalme, 8.viii.1933 (*Ossiannilsson*). NORWAY: 2 ♂, 4 ♀, Ny Sulitjelma, 67°9′N. 16°8′E., 6.viii.1961; 3 ♀, Ny Sulitjelma, 67°9′N. 16°8′E., 7.viii.1961; 1 ♂, 1 ♀, Jotunheimen Gjendesheim, 1000–1500 m, 7.vii.1966 (*Benson*); 5 ♂, 3 ♀, Kongsvold, Dovre, 7.vii.1933 (*Nordman*); 1 ♀, Rogaland, 11.vii.1940 (*Holgersen*). FINLAND: 2 ♀, Lapland, Enontekio, in birch zone below S.E. slopes of Tshuukisvaara, 15.viii.1957 (*Scott*); 3 ♀, Lapland, Enontekio, in birch zone below S.E. slopes of Tshuukisvaara, 15.viii.1957 (*Groves*). U.S.S.R.: 1 ♂, Urals, Lipin, 21–23.vii.1927 (*Flerov*); 1 ♂, Petsamo, Linnaniemi. All in BMNH.

The type-series of *Cicada abdominalis limbatella* Zetterstedt, deposited in the UZI, Lund, and consisting of one male labelled '85' and 'var. b. limbatella. ♂.' and another male without labels, was examined. The male with the above labels is here designated as lectotype and the other as paralectotype.

This species was originally included in *Diplocolenus* by Ribaut (1946 : 85).

### ***Diplocolenus* (*Erdianus*) *sichotanus*** Anufriev

(Text-figs 106 & 107)

*Diplocolenus sichotanus* Anufriev, 1971 : 115. Holotype ♂, U.S.S.R.: Primorski Krai, Sikhote-Alin Reserve, upper reaches of Sakhalin stream, 25.vi.1967 (*Anufriev*) (ZI, Leningrad) [not examined].

Length: ♂ 4·10–4·20 mm (mean 4·15 mm); ♀ 3·60–4·08 mm (mean 3·84 mm).

Colour as in *limbatellus*.

Male genitalia as in *limbatellus* but with shaft of aedeagus relatively wider, apical processes larger and directed more laterad and with subapical processes larger and directed more ventrad.

DISTRIBUTION. Mongolia and Primorsk Territory, U.S.S.R.

MATERIAL STUDIED.

U.S.S.R.: 2 ♂, 1 ♀, Primorsk Territory, Sikhote-Alin Reserve, 7.vii.1967 (*Anufriev*) (paratypes of *Diplocolenus sichotanus* Anufriev) (BMNH). MONGOLIA: 1 ♂, 1 ♀, Bulgan, 6.viii.1965 (*Dlabola*) (GAA, Gorky).

### ***Diplocolenus* (*Erdianus*) *kyrilli*** Emeljanov

(Text-figs 104 & 105)

*Diplocolenus kyrilli* Emeljanov, 1966 : 123. Holotype ♂, U.S.S.R.: Kazakhstan, Saur Mountains, Alatay Gorge, 10.vii.1962 (*Emeljanov*) (ZI, Leningrad) [not examined].

Length: ♂ 3·7 mm.

Colour as in *limbatellus*.

Male genitalia as in *limbatellus* but with apical processes of the aedeagus less divergent and subapical processes relatively larger and directed more dorsad.

DISTRIBUTION. Altayskaya Province and Kazakhskaya Republic, U.S.S.R.

MATERIAL STUDIED.

U.S.S.R.: 1 ♂, Altay, Ust-Kan, 8.vii.1923 (*Vinogradov*) (paratype of *Diplocolenus kyrilli* Emeljanov) (BMNH).

The close similarity between *limbatellus*, *sichotanus* and *kyrilli* suggests that they may be the same species although longer series from throughout their respective ranges are required for confirmation. *D. limbatellus* is a northern species whilst both *sichotanus* and *kyrilli* occur in the southern and more eastern parts of the Palaearctic.

### ***Diplocolenus*** **(*Erdianus*)** ***kaszabi*** Dlabola

(Text-figs 108 & 109)

*Diplocolenus kaszabi* Dlabola, 1965 : 122. Holotype ♂, MONGOLIA: Central Aimak, Ulan-Baator, Zaisan [not 'Nucht' as stated by Dlabola] im Bogdo ul, 1420–1500 m, 18.vi.1963 [not '1500 m' and '16.vi.1963' as stated by Dlabola] (*Kaszab*) (TM, Budapest) [examined].

Length: ♂ 3·60–3·94 mm (mean 3·77 mm).

Male genitalia as in *limbatellus* but with apical processes of aedeagus broadly cleft apically.

DISTRIBUTION. Mongolia.

MATERIAL STUDIED.

Holotype ♂ of *Diplocolenus kaszabi* Dlabola (TM, Budapest).

1 ♂ paratype of *Diplocolenus kaszabi* Dlabola, same data as holotype (TM, Budapest); 1 ♂ paratype of *Diplocolenus kaszabi* Dlabola, same data as holotype (NM, Prague).

### ***Diplocolenus*** **(*Erdianus*)** ***bensoni*** (China)

(Text-figs 110 & 111)

*Euscelis bensoni* China, 1933 : 107. LECTOTYPE ♂, GREAT BRITAIN: Scotland, Perthshire, Ben Lawers, 2000', –vi.1932 (*Benson*) (BMNH), here designated [examined].

*Deltocephalus obenbergeri* Dlabola, 1945 : 173. Holotype ♂, CZECHOSLOVAKIA: Bohemia, Krkonoše, Kotelné jámy, 10.vii.1922 (*Novicky & Ogloblin*) (NM, Prague) [examined].

*Deltocephalus bohemicus* Lang, 1947 : 93. ♂♀ syntypes [number not stated], CZECHOSLOVAKIA: Bohemia, Sumava Mountains, Boubin, 1362 m, 19.vii.1937, Modrava, 21.vii.1937 (*Lang*) (NM, Prague) [not examined].

Length: ♂ 3·50–3·60 mm (mean 3·55 mm); ♀ 4·04–4·32 mm (mean 4·18 mm).

Colour pale green, fore wings, and sometimes vertex, pronotum and scutellum, usually densely speckled with brown; face and venter dark brown; legs stramineous marked with dark brown.

Male genitalia as in *limbatellus* but with shaft of aedeagus more elongate and apical processes slender.

DISTRIBUTION. Great Britain, Norway, Netherlands, France, Poland and Czechoslovakia.

MATERIAL STUDIED.

Lectotype ♂ of *Euscelis bensoni* China (BMNH); holotype ♂ of *Deltocephalus obenbergeri* Dlabola (NM, Prague).

GREAT BRITAIN: 4 ♂, 3 ♀, Scotland, Perthshire, Ben Lawers, 1500', 27.vi.1936 (BMNH); 1 ♂, England, Cumberland, Hard Knott Pass, 1290', 19.vi.1936 (*Smart*) (BMNH). NORWAY: 1 ♂, 1 ♀, Rogaland, Suldal, 7–9.vii.1941 (*Holgersen*) (BMNH). POLAND: 2 ♀, Gory Jzerskie, Podmokta, hala, 12.vii.1958 (*Trojan*) (IZPAN, Warsaw); 1 ♂, Gory Jzerskie, Lwowek Slaski, Stog Jzerski, 10.vii.1958 (*Trojan*)

(IZPAN, Warsaw); 1 ♂, Gory Jzerskie, 17.vii.1960 (*Bankowska*) (IZPAN, Warsaw). CZECHOSLOVAKIA: 1 ♂, Bohemia, Sumava, Modrava, Kočmíd, –.viii.1951 (NM, Prague); 2 ♂, 3 ♀, Bohemia, Sněžka, 1600 m, 2.viii.1965 (*Dlabola*) (NM, Prague); 1 ♀, Bohemia, Krkonoše, Kotelné jámy, 10.vii.1922 (*Novicky & Ogloblin*) (paratype of *Deltocephalus obenbergeri* Dlabola) (NM, Prague).

Of the original two specimens in the type-series of *Euscelis bensoni*, only one male, labelled 'Perthshire Ben Lawers 2,000′ vi. 1932 R. B. Benson' and 'Euscelis bensoni China TYPE det. W. E. China 1932', is present in the BMNH. This specimen is here designated as lectotype.

*Euscelis bensoni* was first transferred to *Diplocolenus* by China (1950 : 245). *Deltocephalus obenbergeri* was transferred to *Diplocolenus* by Ribaut (1952 : 282) who in the same work (p. 287) listed *Deltocephalus bohemicus* as its synonym for the first time. *D. obenbergeri* was synonymised with *bensoni* by LeQuesne (1969 : 86).

This species, with its slender aedeagal processes, appears to be the primitive form of the *limbatellus* line.

## ***Diplocolenus* (*Erdianus*) *convenarum* Ribaut**

(Text-figs 16, 35, 55, 76, 100 & 101)

*Deltocephalus montanus* Ribaut, 1936 : 259. Holotype ♂, FRANCE: Hautes-Pyrénées, Loudervielle (depository unknown) [not examined]. [Primary homonym of *Deltocephalus montanus* Distant, 1908 : 384.]

*Diplocolenus convenarum* Ribaut, 1946 : 85. [Replacement name for *Deltocephalus montanus* Ribaut, 1936.]

Length: ♂ 3·8 mm.

Colour pale green with apex of apical cells fuscous; face and venter dark brown; legs stramineous marked with dark brown.

Male genitalia with pygophore as wide as long, terminating posteroventrally in a short robust ventrally directed process, without membranous expansion on dorsal margin; Xth segment with sides strongly divergent towards base, not reaching apex of pygophore, sclerotized ventrally along posterior margin; subgenital plates with finger-like apex nearly twice as long as wide, without setae, lateral row of setae uniseriate, plates reaching apex of pygophore; styles with apical process slender and curving laterally, lateral lobe well developed; connective shorter than styles, arms parallel distally and fused for only short distance of length; aedeagus with shaft elongate, straight, directed dorsoposteriorly and terminating in a pair of short dorsally directed processes, basal apodeme short with dorsolateral corners strongly produced dorsolaterally.

DISTRIBUTION. France.

MATERIAL STUDIED.

FRANCE: 1 ♂, Ariège, Saint Béat (*Ribaut*) (paratype of *Deltocephalus montanus* Ribaut) (BMNH).

This species was originally included in *Diplocolenus* by Ribaut (1946 : 85).

### ***Diplocolenus* (*Erdianus*) *quadrivirgatus* (Horvath)**

(Text-figs 17, 36, 56, 75, 112 & 113)

*Deltocephalus quadrivirgatus* Horvath, 1884 : 319. LECTOTYPE ♂, HUNGARY: Mármaros, Pop Ivan, 20.vii.1883 (TM, Budapest), here designated [examined].

[*Deltocephalus nigricans* Kirschbaum; Nast, 1938 : 163. Misidentification.]

*Deltocephalus nasti* Wagner, 1939 : 168. ♂ ♀ syntypes, U.S.S.R.: Carpathians, 3 ♀, mountain ridge between Mt. Gorgan & Mt. Siwula, 1400 m, 15.vii.1937 (*Tarwid*), 1 ♀, slopes of Mt. Siwula & Lopuszna, 1400–1450 m, 15.vii.1937 (*Tarwid*), 1 ♂, 3 ♀, meadows on the slopes of Grofe-Berges, 1400–1550 m, 24.vii.1937 (*Tarwid*), 1 ♀, meadow below summit of Mt. Wysoka, 1680 m, 3.viii.1937 (*Tarwid*) (destroyed[5]). [Proposed as 'nom. nov.' for *Deltocephalus nigricans* Kirschbaum sensu Nast, 1938 : 163. **Syn. n.**

Length: ♂ 3·60–4·18 mm (mean 3·89 mm); ♀ 4·92 mm.

Colour pale green with transverse band across vertex, pronotum, scutellum, apex and medial areas of fore wings, face, venter and legs dark brown, latter sometimes pale and poorly developed.

Male genitalia with pygophore as wide as long, terminating posteroventrally in a short robust ventrally directed process, a narrow membranous expansion from dorsal margin; Xth segment with sides convex, not reaching apex of pygophore, sclerotized ventrally on posterior margin; subgenital plates with finger-like apex approximately 1½ times as long as its basal width with a uniseriate row of setae over its ventral surface, lateral row of setae multiseriate, plates slightly exceeding apex of pygophore; styles with apical process slender, curving laterally, lateral lobe well developed; connective shorter than styles, arms parallel distally and fused for only very short part of length; aedeagus with shaft elongate, directed dorsally with distal third turned posteriorly, terminating in two pairs of slender processes of approximately equal length, one pair directed dorsally and the other directed ventrally, basal apodeme short with dorsolateral corners produced dorsolaterally.

DISTRIBUTION. S.E. Europe.

MATERIAL STUDIED.

Lectotype ♂ and paralectotypes of *Deltocephalus quadrivirgatus* Horvath (TM, Budapest).

HUNGARY: 1 ♂, 1 ♀, Gyulafalva, Górhavas, Aigner (TM, Budapest). BULGARIA: 1 ♂, 1 ♀, Rila, 2000 m, 12.viii.1959 (*Burakowski*) (BMNH). U.S.S.R.: 1 ♂, Ukraine, Transcarpathian Province, Krasnaya, 2.vii.1961 (*Loginova*) (BMNH).

The type-series of *Deltocephalus quadrivirgatus* Horvath, deposited in the TM, Budapest, consists of a male labelled 'Mármaros Pop Ivan 20.7.83' and a female and one other specimen without an abdomen with the same data. All three specimens were examined and the male is here designated as lectotype and the other two specimens as paralectotypes.

This species was described and figured by Nast (1938 : 163, fig. 2) as *Deltocephalus nigricans* Kirschbaum. Wagner (1939 : 168), after studying Kirschbaum's types, found Nast's species to be distinct from *D. nigricans* Kirschbaum and renamed it *Deltocephalus nasti*. Ribaut (1946 : 85) listed it as one of the originally included species in *Diplocolenus*.

It is the most primitive member of the *quadrivirgatus*/*quadricornis*/*nigricans*/*penthopitta* group and still retains the slender form of the aedeagus and apical processes.

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[5] Destroyed by fire in the Zoological Museum, Warsaw, in 1944 (Dr I. Dworakowska, personal communication).

### ***Diplocolenus* (*Erdianus*) *quadricornis*** Ribaut

*Diplocolenus* (*Sabelanus*) *quadricornis* Ribaut, 1959 : 402. Holotype ♂, FRANCE: Alpes-Maritimes, Esteng, –.vii.1956 (*Tempère*) (? SC, Strasbourg) [not examined].

This species, which is well illustrated by Ribaut (1959 : 401, figs 8–11), is closely related to *quadrivirgatus*, *penthopitta* and *nigricans*. It resembles all three species in the shape of the pygophore and has a long finger-like apex to the subgenital plate as in *penthopitta* and *nigricans*. The apical process of the style is similar to that of *quadrivirgatus* and *nigricans*. The aedeagus is intermediate in shape between *quadrivirgatus* and *nigricans* with the shaft short straight and robust and terminating in two pairs of stout processes, a short dorsal pair and a slightly longer ventral pair.

DISTRIBUTION. S.W. France.

MATERIAL STUDIED. No specimens were available for the present study.

This species still retains the distinct apical processes to the aedeagus seen in *quadrivirgatus* but has undergone a general shortening of the aedeagus and an extension of the apical process on the subgenital plate.

### ***Diplocolenus* (*Erdianus*) *nigricans*** (Kirschbaum)

(Text-figs 19, 38, 58, 72, 116, 117 & 118)

*Jassus* (*Deltocephalus*) *nigricans* Kirschbaum, 1868 : 129. ♂♀ syntypes [number not stated], SWITZERLAND: Bernina (*Heyden*) (? NM, Wiesbaden) [not examined].

Length: ♂ 4·1 mm; ♀ 4·7 mm.

Colour pale green with apex of apical cells fuscous; face and venter dark brown; legs stramineous marked with dark brown.

Male genitalia with pygophore slightly longer than wide, terminating posteroventrally in a short robust posteroventrally directed process, with a small membranous expansion from dorsal margin; Xth segment with sides convex, not reaching apex of pygophore, sclerotized ventrally along posterior margin; subgenital plates with finger-like apex twice as long as wide with a row of setae over apical half of ventral surface, lateral row of setae uniseriate, plates reaching to apex of pygophore; styles with apical process slender and curving laterally, lateral lobe well developed; connective slightly longer than styles, arms parallel distally and fused over large part of length; aedeagus with shaft short, directed dorsally with distal third turned dorsoposteriorly and expanded at apex into broad umbrella-like plate perpendicular to shaft. its anterior margin deeply and narrowly incised.

DISTRIBUTION. Southern Europe.

MATERIAL STUDIED.

AUSTRIA: 1 ♂, 1 ♀, Trentino, Yal Sugana, Panarotta (LC, Raisio).

This species was originally included in *Diplocolenus* by Ribaut (1946 : 85). It is one of the most specialized forms of the *quadrivirgatus*/*quadricornis*/*nigricans*/*penthopitta* line, in which the apical processes of the aedeagus have become fused to form a terminal plate.

## ***Diplocolenus* (*Erdianus*) *penthopitta*** (Walker) **nom. rev.**

(Text-figs 18, 37, 57, 73, 114 & 115)

*Bythoscopus* ? *Penthopitta* Walker, 1851 : 864. ♀ type(s) [number not stated], FRANCE: (*Perris*) (depository unknown) [not examined].

*Acocephalus sudeticus* Kolenati, 1860 : 390. NEOTYPE ♂, CZECHOSLOVAKIA: Moravia, Hr. Jeseník-Praděd, 21.ix.1970 (*Lauterer*) (MM, Brno), here designated [examined]. **Syn. n.**

Length: ♂ 3·82–4·30 mm (mean 4·02 mm); ♀ 4·42–4·62 mm (mean 4·50 mm).

Colour uniformly dark brown or with vertex, pronotum and fore wings pale green or cream variably marked with dark brown.

Male genitalia with pygophore as long as wide, terminating posteriorly in a short robust ventrally directed process, with a narrow membranous expansion from dorsal margin; Xth segment with sides convex, not reaching apex of pygophore, sclerotized ventrally along posterior margin; subgenital plates with finger-like apex twice as long as wide with cluster of setae on apical half of ventral surface, lateral row of setae uniseriate, plates exceeding apex of pygophore; styles with apical process short, robust, curving laterally, lateral lobe well developed; connective longer than styles, arms parallel distally and fused over short distance of length; aedeagus with shaft short and broadly lamellate with lateral margins curving ventrally, terminating in a pair of short ventrally directed processes, basal apodeme short and broad.

DISTRIBUTION. E. Europe.

MATERIAL STUDIED.

Neotype ♂ of *Acocephalus sudeticus* Kolenati (MM, Brno).

CZECHOSLOVAKIA: 2 ♂, 6 ♀, Moravia, Hr. Jesenik, Petrovy kameny, 19.ix.1970 (*Lauterer*) (MM, Brno); 3 ♂, 8 ♀, Moravia, Hr. Jesenik-Vel. Kotel, 20.ix.1970 (*Lauterer*) (MM, Brno); 4 ♂, Moravia, Hr. Jesenik-Praděd, 21.ix.1970 (*Lauterer*) (MM, Brno); 1 ♂, Bohemia, Velká, Deštná, 1114 m, Orlické h., 6.viii.1945 (*Polacek*) (NM, Prague); 1 ♂, 1 ♀ Moravia, Jeseniky, –.ix.1946 (*Dlabola*) (BMNH); 1 ♂, Sudeten (*Hedwig*) (WW, Hamburg). AUSTRIA: 1 ♀, Schneeberg, 19.vii.1941 (*Hedwig*) (WW, Hamburg). POLAND: 1 ♂, 1 ♀, Klodzko, 2.viii.1958 (*Trojan*) (IZPAN, Warsaw).

The Kolenati Collection, containing the type-series of *Acocephalus sudeticus*, could not be located in either Czechoslovakia[6] or the Naturhistorisches Museum, Vienna,[7] and is presumed to have been destroyed. A topotype male labelled 'Mor. bor. 21.9.1970 Hr. Jeseník-Praděd lgt. P. Lauterer 49/70' is here designated as neotype and is deposited in the MM, Brno.

This species was first described by Amyot (1847 : 219) with the non-binomial, and hence unavailable, name *Penthopitta*. The name was subsequently used binomially by Walker (1851 : 864) who placed it in the genus *Bythoscopus*. Although Walker gave no description, he referred to Amyot's work and thereby satisfied Articles 11, 12 and 16 of the *International Code of Zoological Nomenclature*. Walker's work has gone unnoticed by subsequent workers, the name *penthopitta* having been attributed to Fieber (1869 : 221) and therefore erroneously considered, since Lang (1947 : 20), as a junior synonym of *sudeticus* Kolenati, 1860.

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[6] Dr J. Stehlik, personal communication.

[7] Dr A. Kaltenbach, personal communication.

This species was originally included in *Diplocolenus* by Ribaut (1946 : 85). It is the most specialized form of the *quadrivirgatus/quadricornis/nigricans/penthopitta* line in which the anterior processes of the aedeagus have been lost and the atrium has been extended ventrally. It is further specialized by the reduction of the apical process of the style.

### ***Diplocolenus*** **(*Verdanus*)** ***evansi*** (Ashmead)

(Text-figs 20, 39, 59, 78, 119 & 120)

*Deltocephalus evansi* Ashmead, 1904 : 132. LECTOTYPE ♂, ALASKA: Kussiloff, –.vii.1898 (*Evans*) (USNM, Washington), here designated [examined].

*Diplocolenus dauricus* Emeljanov, 1966 : 123. Holotype ♂, U.S.S.R.: Chitinskaya Province, R. Talanguy, south of Zhuravlev, 4.viii.1963 (*Emeljanov*) (ZI, Leningrad) [not examined]. **Syn. n.**

Length: ♂ 3·40–4·00 mm (mean 3·70 mm); ♀ 3·70–4·20 mm (mean 3·90 mm).

Colour pale green with apex of apical cells fuscous; face and venter dark brown; legs stramineous marked with dark brown.

Male genitalia with pygophore as long as wide, terminating posteroventrally in a short robust ventrally directed process, a large semimembranous expansion from dorsal margin; Xth segment with sides strongly convex, extending to apex of pygophore, sclerotized ventrally along posterior margin; subgenital plates with finger-like apex slightly longer than wide, without setae on ventral surface, lateral row of setae uniseriate, plates extending to apex of pygophore; styles with apical process slender curving laterally, lateral lobe well developed; connective approximately half length of styles, arms widely separated and divergent distally to near apex and then abruptly angled to midline and fused; aedeagus with shaft elongate, directed dorsally with apex turned posteriorly and terminating in a pair of long slender processes directed laterally for approximately one third length and then abruptly ventrolaterally, basal apodeme long and narrow with dorsolateral corners produced dorsally.

DISTRIBUTION. Northern U.S.A., Canada, Alaska and eastern U.S.S.R.

MATERIAL STUDIED.

Lectotype ♂ of *Deltocephalus evansi* Ashmead (USNM, Washington).

U.S.A.: 1 ♂, 2 ♀, Colorado, Waldren, Jackson Co., 9.viii.1964 (*Knowlton*); 1 ♀, Colorado, Steamboat Springs, 9.viii.1964 (*Knowlton*); 1 ♀, Colorado, Lindland, 12.viii.1964 (*Knowlton*); 1 ♂, Colorado, Gould, 14.viii.1966 (*Knowlton*); 1 ♀, Montana, Bozeman, 19.vii.1920 (*Downes*). CANADA: 1 ♂, 7 ♀, Ontario, Black Sturg. Lake, 1–15.viii.1956 (*Lindberg*); 1 ♀, B.C., Chilcotin, 9.vi.1929 (*Downes*); 1 ♂, Alberta, McMurray, 7.viii.1953 (*Ball*); 2 ♂, 10 ♀, Labrador, Kinriakak Point, L. Melville, 20–21.viii.1958, B.S.E.S. Expedition; 3 ♂, 17 ♀, Labrador, Hopedale, 13.viii.1935, 8 ♂, 13 ♀, 16.vii.1935, 1 ♂, 14 ♀, 19.viii.1935, 12 ♀, 12.viii.1935, 1 ♀, 14.viii.1936, 1 ♀, 7.viii.1936 (*Perrett*). U.S.S.R.: 1 ♂, Kamchatka, River Kamchatka, Klyuchevskaya, 15.vi.1909 (*Derjabin*); 1 ♂, Transbaikalia, Tyrgituy, S. of Chita, 22.vi.1914 (*Gavrilyuk*). All in BMNH.

According to Ashmead (1904 : 133) the type of *Deltocephalus evansi*, with the data 'Kusilof, July, 1898 (W. H. Evans)', bears the catalogue number 6869 in the USNM, Washington. He also refers to additional specimens from Metlakatla collected on 4th July. Only a male and a female, each with the data 'Kussiloff, Alaska, July 1898, W. H. Evans' but without a catalogue number, are present in the USNM[8]. The male, which was examined, is here designated as lectotype.

Emeljanov (1966 : 123) considers *dauricus* to differ from *evansi* by having longer apical processes on the aedeagus with the part basad of the bend being shorter than the distal part rather than the reverse as in *evansi*. An examination of *evansi* specimens from throughout its range, however, shows Emeljanov's interpretation of the species to be incorrect and that both species are the same.

*Deltocephalus evansi* was made the type-species of *Verdanus* by Oman (1949 : 165) and transferred to the present genus for the first time by Ribaut (1952 : 285) who considered *Verdanus* as a subgenus of *Diplocolenus*. Apart from the more primitive *configuratus* it is the only species of the genus which has dispersed into the New World although unlike *configuratus* it is not endemic.

### ***Diplocolenus* (*Verdanus*) *abdominalis*** (Fabricius)

(Text-figs 5, 6, 21, 40, 60, 79, 121 & 122)

*Cicada bicolor* Fabricius, 1794 : 40. LECTOTYPE ♂, DENMARK: (UZM, Copenhagen), here designated [examined]. [Primary homonym of *Cicada bicolor* Olivier, 1790 : 743.]

*Cercopis abdominalis* Fabricius, 1803 : 98. [Replacement name for *Cicada bicolor* Fabricius, 1794.]

*Cicada balteata* Zetterstedt, 1840 : 290. LECTOTYPE ♀, SWEDEN: Lapland, 30.vi.– (*Zetterstedt*) (UZI, Lund), here designated [examined].

*Aphrodes juvenca* Hardy, 1850 : 425. Holotype [sex not stated], GREAT BRITAIN: Scotland, Berwickshire (depository unknown).

Length: ♂ 3·8–4·4 mm (mean 4·2 mm); ♀ 3·7–4·2 mm (mean 4·0 mm).

Colour pale green with apex of apical cells fuscous; face and venter dark brown; legs stramineous marked with dark brown.

Male genitalia with pygophore longer than wide, without posterior process, with a broad semi-membranous expansion from dorsal margin; Xth segment with sides strongly convex, not reaching apex of pygophore, not sclerotized ventrally; subgenital plates with finger-like apex approximately as long as wide, without setae on ventral surface, lateral row of setae uniseriate, plates not reaching apex of pygophore; styles with apical process slender and curving laterally, lateral lobe well developed; connective approximately two thirds length of styles, arms widely separated and divergent distally to near apex and then abruptly angled to midline where fused; aedeagus with shaft elongate, directed dorsally with apex turned posteriorly and terminating in a pair of long slender processes directed laterally and then bifurcating into branches of approximately equal length, one directed ventrolaterally and the other anterodorsally, basal apodeme long and narrow with dorsolateral corners produced dorsally.

DISTRIBUTION. Great Britain, Europe, Scandinavia, N. Africa, U.S.S.R. and Mongolia.

MATERIAL STUDIED.

Lectotype ♂ of *Cicada bicolor* Fabricius (UZM, Copenhagen); lectotype ♀ of *Cicada balteata* Zetterstedt (UZI, Lund).

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[8] Dr J. P. Kramer, personal communication.

AUSTRIA: 1 ♂, 2 ♀, Hochschwab, 2000 m; 1 ♀, Tyrol, Kitzbuhel, 18–29.viii.1962 (*Hayes*); 1 ♂, 1 ♀, Tyrol, Landeck, –.vi.1957 (*Day & Ward*); 1 ♂, 3 ♀, Hainfeld (*Eger*). FRANCE: 1 ♀, Vienne, St. Benoit. ITALY: 1 ♀, Merano, 23.vii.1957 (*Ward*). NORWAY: 1 ♂, 2 ♀, Rogaland, Suldal, 7–9.vii.1941 (*Holgersen*). POLAND: 2 ♂, Zakopane, Tatra Mts., 2,300′, 27.vi.1932 (*Aubertin & Trewavas*). All in BMNH.

In the original description of *Cicada balteata* there was no indication of the number of specimens in the type-series although only females were studied. There is a single female type of this species in the UZI, Lund, which was examined and is here designated as lectotype.

There is only one specimen in the type-series of *Cicada bicolor* in the UZM, Copenhagen, which was examined and is here designated as lectotype.

*Cicada balteata* was first synonymized with *abdominalis* by Thomson (1869 : 66) and *Aphrodes juvenca* synonymized with *abdominalis* and *balteata* by Douglas & Scott (1876 : 89). The species was originally included in *Diplocolenus* by Ribaut (1946 : 85). It is the only species amongst the more specialized members of the genus that has become widely distributed throughout the Palaearctic Region, the majority being restricted to various parts of Europe or the south-west U.S.S.R.

## ***Diplocolenus* (*Verdanus*) *temperei* Ribaut**

*Diplocolenus temperei* Ribaut, 1959 : 402. Holotype ♂, FRANCE: Cantal, Le Lioran, 1.vi.1955 (*Tempère*) (? SC, Strasbourg) [not examined].

This species, which is well illustrated by Ribaut (1959 : 401, figs 5–7), is closely related to *abdominalis* but differs in having the two branches of each apical process of the aedeagus in an approximately straight line with each other rather than at right angles.

DISTRIBUTION. S.E. France.

MATERIAL STUDIED. No specimens were available for the present study.

## ***Diplocolenus* (*Verdanus*) *laetitiae* Servadei**

(Text-figs 123 & 124)

*Diplocolenus laetitiae* Servadei, 1960 : 330. Holotype [sex not stated], ITALY: Calabria (IEA, Padua) [not examined].

Length: ♂ 4·46 mm.

Colour as in *abdominalis*.

Male genitalia as in *abdominalis* but with apical processes of aedeagus closer together, with dorsal branch much shorter than ventral, distal half of shaft of aedeagus thicker than basal half and with apical process of styles directed more laterad at apex.

DISTRIBUTION. Southern Italy.

MATERIAL STUDIED.

ITALY: 1 ♂, Calabria, Lake Arvo, 31.v.1959 (*Servadei*) (LC, Raisio).

This species is closely related to *abdominalis*.

### ***Diplocolenus* (*Verdanus*) *rustavelicus*** Logvinenko

*Diplocolenus rustavelicus* Logvinenko, 1971 : 591. ♂ ♀, syntypes, U.S.S.R.: Georgia, Abastumani, Zekarskii Pass, 2000 m, 30.vi.1967–1.vii.1967 (IZ, Kiev) [not examined].

This species, which is illustrated by Logvinenko (1971 : 591, fig. 2), is similar to *laetitiae* in having the dorsal branch of the aedeagal processes much shorter than the ventral branch. It differs, however, in having the shaft of the aedeagus of uniform width except for a slight enlargement on each side near midlength.

DISTRIBUTION. Caucasus, U.S.S.R.

MATERIAL STUDIED. No specimens were available for the present study.

This species is very similar to *laetitiae* and may be the same species.

### ***Diplocolenus* (*Verdanus*) *monticola*** Linnavuori **stat. n.**

(Text-figs 125 & 126)

*Diplocolenus abdominalis monticola* Linnavuori, 1958 : 303. Holotype ♂, ITALY: Umbria, Mt. Sibillini, Pian Perduto, –.vii.1954 (*Ruffo*) (LC, Raisio) [examined].

Length: ♂ 4·5 mm.

Colour as in *abdominalis*.

Male genitalia as in *abdominalis* but with apical processes of aedeagus much shorter and more robust and with shaft curving posteriorly from midlength.

DISTRIBUTION. Central Italy.

MATERIAL STUDIED.

Holotype ♂ of *Diplocolenus abdominalis monticola* Linnavuori (LC, Raisio).

### ***Diplocolenus* (*Verdanus*) *exsiliatus*** Emeljanov

(Text-figs 22, 41, 61, 80, 127 & 128)

*Diplocolenus exsiliatus* Emeljanov, 1966 : 123. Holotype ♂, U.S.S.R.: Yakutia, Verkhoyansk, –.vi–vii.1903 (*Rozhnovskiy*) (ZI, Leningrad) [not examined].

Length: ♂ 4·2 mm.

Colour pale green with apex of apical cells fuscous; face and venter dark brown; legs stramineous marked with dark brown.

Male genitalia with pygophore longer than wide, without posterior process, with broad semi-membranous expansion from dorsal margin; Xth segment with sides strongly convex, not reaching apex of pygophore, sclerotized ventrally along posterior margin; subgenital plates with finger-like apex slightly longer than wide with a few setae on ventral surface, lateral row of setae uniseriate, plates not reaching apex of pygophore; styles with apical process slender and curving laterally, lateral lobe well developed; connective half length of styles, arms widely separated and divergent distally to near apex and then abruptly angled to midline where fused; aedeagus with shaft long and slender, directed dorsally to near midlength and then curving gradually posteriorly and terminating in a pair of small laterally directed leaf-like processes, basal apodeme long and narrow with dorsolateral corners produced dorsally.

DISTRIBUTION. Yakutskaya Republic, U.S.S.R.

MATERIAL STUDIED.

U.S.S.R.: 1 ♂, Yakutia, Verkhoyansk, –.vi–vii.1903 (*Rozhnovskiy*) (paratype of *Diplocolenus exsiliatus* Emeljanov) (BMNH).

### ***Diplocolenus*** **(*Verdanus*)** ***caucasicus*** Emeljanov

*Diplocolenus caucasicus* Emeljanov, 1962 : 180. Holotype ♂, U.S.S.R.: Caucasus, Arkhyz, Kafiragura, 22.vii–6.viii.1939 (*D'yakonov*) (ZI, Leningrad) [not examined].

This species, of which only the aedeagus is illustrated by Emeljanov (1962 : 179, figs 90–91), is similar to *exsiliatus* in having the apical processes of the aedeagus reduced but differs in having a sinuate dorsally directed shaft. Additional material may show this species to be the same as *exsiliatus*.

DISTRIBUTION. Caucasia, U.S.S.R.

MATERIAL STUDIED. No specimens were available for the present study.

### ***Diplocolenus*** **(*Verdanus*)** ***tianshanicus*** Emeljanov

(Text-figs 23, 42, 62, 81, 129 & 130)

*Diplocolenus tianshanicus* Emeljanov, 1966 : 122. Holotype ♂, U.S.S.R.: Kirgizia, Terskey-Alatau, R. Chon-Kyzyl-Su, 8.vii.1964 (*Vtorov*) (ZI, Leningrad) [not examined].

Length: ♂ 4·0 mm.

Colour pale green with apex of apical cells fuscous; face and venter dark brown; legs stramineous, marked with dark brown.

Male genitalia with pygophore as long as wide, terminating posteroventrally in a short ventrally directed process, a broad semi-membranous expansion from dorsal margin; Xth segment with sides strongly convex, reaching to apex of pygophore, sclerotized ventrally along posterior margin; subgenital plates with finger-like apex nearly twice as long as wide with a small group of setae on ventral surface, lateral row of setae uniseriate or biseriate, plates reaching to apex of pygophore; styles with apical process slender and curving laterally, lateral lobe well developed; connective approximately two-thirds length of styles, arms widely separated and divergent distally and then abruptly angled to midline where fused; aedeagus with shaft long and slender, directed dorsally to near apex and then curved abruptly posteriorly, terminating in a pair of very small lateral processes and a long slender ventrally directed medial process, basal apodeme long and narrow with dorsolateral corners produced dorsally.

DISTRIBUTION. Kirgizskaya Republic and Kazakhskaya Republic, U.S.S.R.

MATERIAL STUDIED.

U.S.S.R.: 1 ♂, Kirgizia, Terskey-Alatau, R. Chon-Kyzyl-Su, 8.vii.1964 (*Vtorov*) (paratype of *Diplocolenus tianshanicus* Emeljanov) (BMNH).

This species, which is unique within the genus in having an additional unpaired process at the apex of the aedeagus, is most closely related to *exsiliatus*.

## ***Diplocolenus* (*Verdanus*) *intermedius*** Emeljanov

(Text-figs 24, 43, 63, 82, 131 & 132)

*Diplocolenus intermedius* Emeljanov, 1964 : 432. Syntypes [sex and number not stated], U.S.S.R.: Caucasia (ZI, Leningrad, and BMNH) [1 ♂ examined].

Length: ♂ 4·10–4·20 mm (mean 4·15 mm).

Colour pale green with apex of apical cells fuscous; face and venter dark brown; legs stramineous, marked with dark brown.

Male genitalia with pygophore as long as wide, without posterior process, with broad semimembranous expansion from dorsal margin; Xth segment with sides strongly convex, not reaching to apex of pygophore, not sclerotized ventrally; subgenital plates with finger-like apex slightly longer than wide, with short row of setae on ventral surface, lateral row of setae uniseriate, biseriate in part, plates not reaching apex of pygophore; styles with apical process slender and curving laterally, lateral lobe well developed; connective approximately two thirds length of styles, arms narrowly divergent to near apex and then abruptly angled to midline where fused; aedeagus with shaft elongate, directed dorsally with apex turned posteriorly and terminating in two pairs of ventrally directed processes, a short apical pair and a much longer subapical pair, basal apodeme long and narrow with dorsolateral corners produced dorsally.

Distribution. West Caucasia, U.S.S.R.

Material studied.

U.S.S.R.: 1 ♂, R. Kichkipe, 2200–2600 m, Karachai, 15.vii.1935 (*Diakonov*) (syntype of *Diplocolenus intermedius* Emeljanov, labelled as 'paratype') (BMNH); 1 ♂, North Caucasus, Arkhyz, 6.viii.1939 (*Diakonov*) (paratype of *Diplocolenus caucasicus* Emeljanov) (BMNH).

## ***Diplocolenus* (*Verdanus*) *oseticus*** Emeljanov

(Text-figs 44, 133 & 134)

*Diplocolenus oseticus* Emeljanov, 1964 : 432. Syntypes [sex and number not stated], U.S.S.R.: Ossettia (ZI, Leningrad, and BMNH) [1 ♂ examined].

Length: ♂ 3·9 mm.

Colour as in *intermedius*.

Male genitalia as in *intermedius* but with apical pair of processes on aedeagus much shorter and with small projection posteroventrally on pygophore.

Distribution. Ossettia, central Caucasia, U.S.S.R.

Material studied.

U.S.S.R.: 1 ♂, Caucasus, Voenno-Osetinsk Region, Turshevo, 19.vi.1913 (*Bartenyev*) (syntype of *Diplocolenus oseticus* Emeljanov, labelled as 'paratype') (BMNH).

The species *oseticus* and *intermedius* represent the early stage in the final evolutionary phase of the genus during which an additional pair of processes are developed at the apex of the aedeagus.

### ***Diplocolenus* (*Verdanus*) *ciscaucasicus*** Emeljanov

(Text-figs 25, 45, 64, 83, 135 & 136)

*Diplocolenus ciscaucasicus* Emeljanov, 1964 : 432. Syntypes [sex and number not stated], U.S.S.R.: Ciscaucasia (ZI, Leningrad, and BMNH) [1 ♂ examined].

*Diplocolenus daghestanicus* Emeljanov, 1964 : 432. Syntypes [sex and number not stated], U.S.S.R.: Daghestan (ZI, Leningrad, and BMNH) [1 ♂ examined]. **Syn. n.**

Length: ♂ 4·20–4·70 mm (mean 4·45 mm).

Colour pale green with apex of apical cells fuscous; face and venter dark brown; legs stramineous, marked with dark brown.

Male genitalia with pygophore slightly longer than wide, without posterior process, with a broad semi-membranous expansion from dorsal margin; Xth segment with sides strongly convex, not reaching apex of pygophore, not sclerotized ventrally; subgenital plates with finger-like apex approximately as long as wide and with small group of setae on ventral surface, lateral row of setae multiseriate, plates not reaching apex of pygophore; styles with apical process slender and curving laterally, lateral lobe well developed; connective approximately two thirds length of styles, arms widely separated and divergent distally to near apex and then abruptly angled to midline where fused; aedeagus with shaft elongate, directed dorsally with apex turned posteriorly and terminating in two pairs of ventrally directed processes, a triangulate posterior pair and a more slender lateral pair, those of each side fused together over their basal halves, basal apodeme long and narrow with dorsolateral corners produced dorsally.

DISTRIBUTION. Caucasus, U.S.S.R.

MATERIAL STUDIED.

U.S.S.R.: 1 ♂, Caucasus, Nizhegorodskaya, Mayk. district, Kuba, 30.v.1911 (*Shaposhnikov*) (syntype of *Diplocolenus ciscaucasicus* Emeljanov, labelled as 'paratype') (BMNH); 1 ♂, Caucasus, Daghestan, Okyuz-tau, Gimrinsk Ridge, 7.vii.1940 (*Ryabov*) (syntype of *Diplocolenus daghestanicus* Emeljanov, labelled as 'paratype') (BMNH).

Both *ciscaucasicus* and *daghestanicus* are described on the same page, with *daghestanicus* having position priority. In the present synonymy, however, *ciscaucasicus* is chosen as the senior synonym as indicating a less restrictive distribution.

### ***Diplocolenus* (*Verdanus*) *admistus*** Logvinenko

*Diplocolenus admistus* Logvinenko, 1966 : 407. Holotype ♂, U.S.S.R.: Northwest Caucasus, Caucasian reservation, Sennaya clearing, 16.viii.1962 (*Logvinenko*) (IZ, Kiev) [examined].

Length: ♂ 4·20 mm.

Colour as in *ciscaucasicus*.

Male genitalia as in *ciscaucasicus* but with posterior or medial pair of processes on aedeagus fused over their basal half, the shaft of the aedeagus more S-shaped and with a small denticle on each lateral margin of basal apodeme.

DISTRIBUTION. N.W. Caucasia, U.S.S.R.

MATERIAL STUDIED.

Holotype ♂ of *Diplocolenus admistus* Logvinenko (IZ, Kiev).

This species is very similar to *ciscaucasicus* and may be the same species.

### ***Diplocolenus* (*Verdanus*) *melichari*** Dlabola

(Text-figs 137 & 138)

*Diplocolenus melichari* Dlabola, 1950 : 178. Holotype ♂, U.S.S.R.: Georgia, Tiflis, 21.viii.1912 (*Zaitsev*) (MM, Brno) [examined].

Length: ♂ 4·22 mm.

Colour as in *ciscaucasicus*.

Male genitalia as in *ciscaucasicus* but with apical processes of aedeagus more slender and independent of each other along their entire length and with lateral pair situated more dorsally on shaft and curving dorsolaterally at base rather than ventrolaterally.

Distribution. Georgia Republic, U.S.S.R.

Material studied.

Holotype ♂ of *Diplocolenus melichari* Dlabola (MM, Brno).

This species is the most highly specialized form within the genus.

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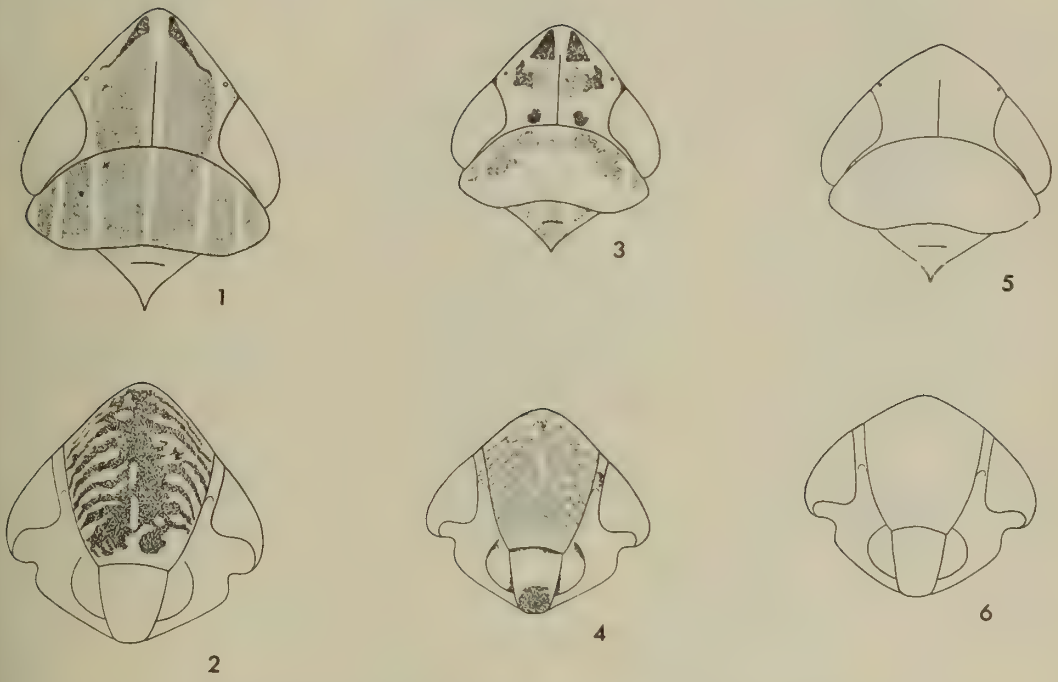
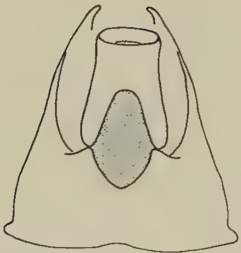


FIGS 1–6. Head, thorax, and face of *Diplocolenus* species. 1 & 2, *bohemani*; 3 & 4, *frauenfeldi*; 5 & 6, *abdominalis*.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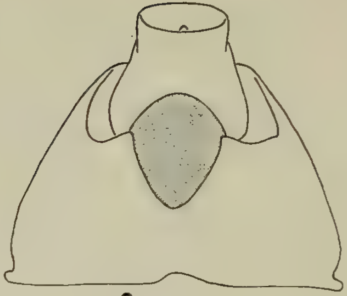
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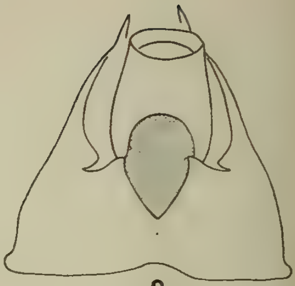
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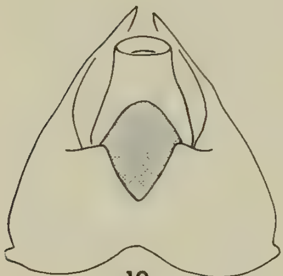
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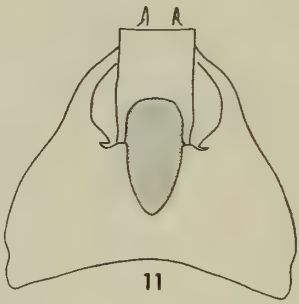
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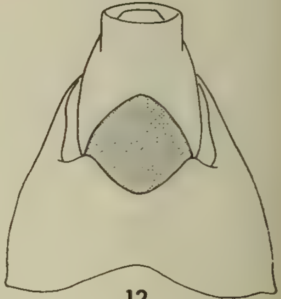
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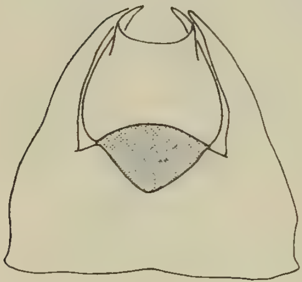
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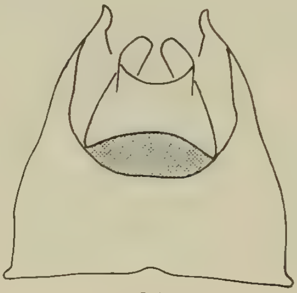
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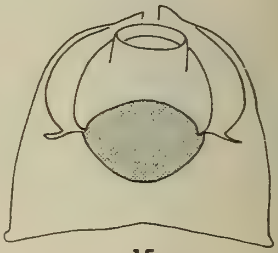
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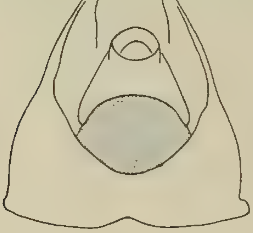
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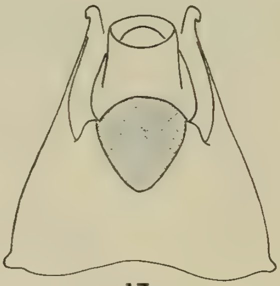
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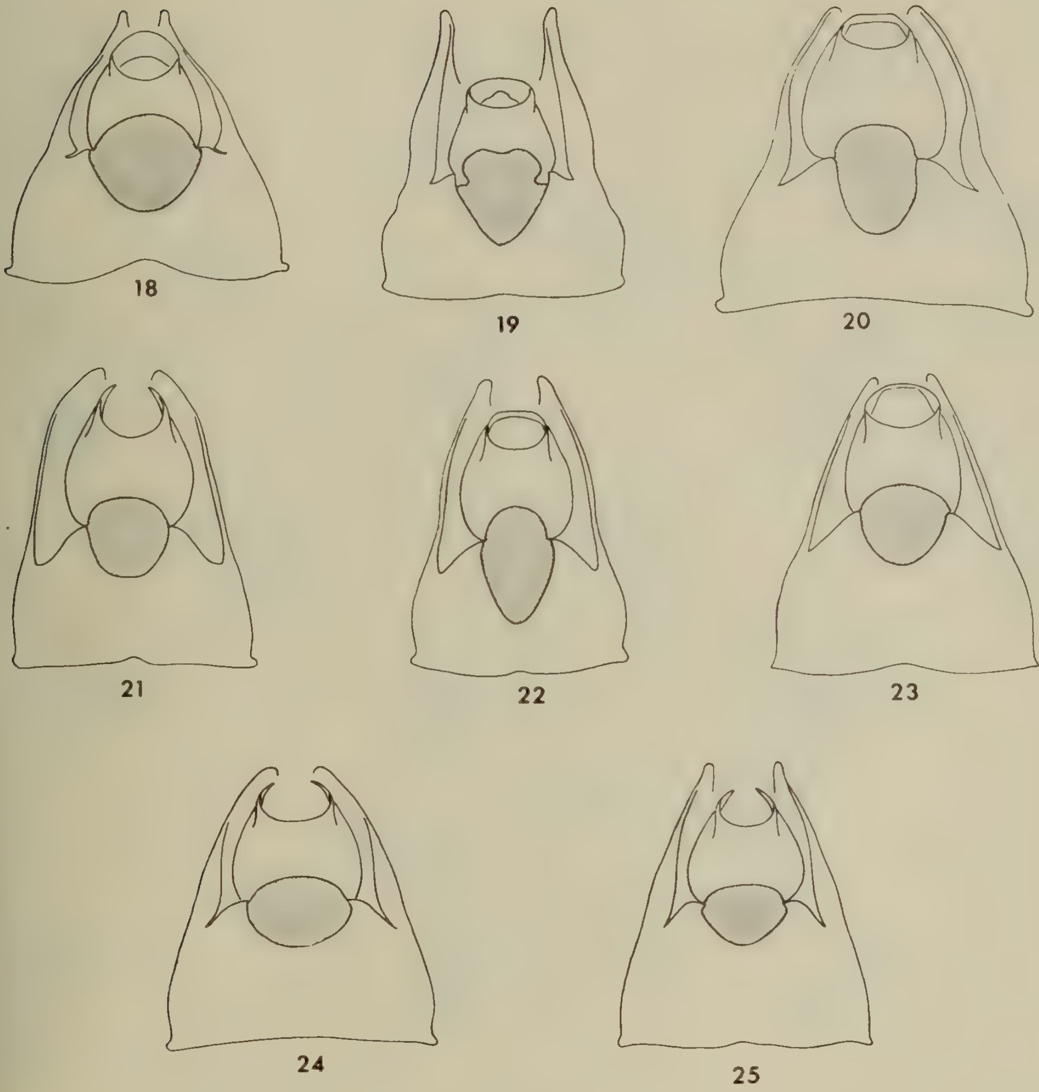
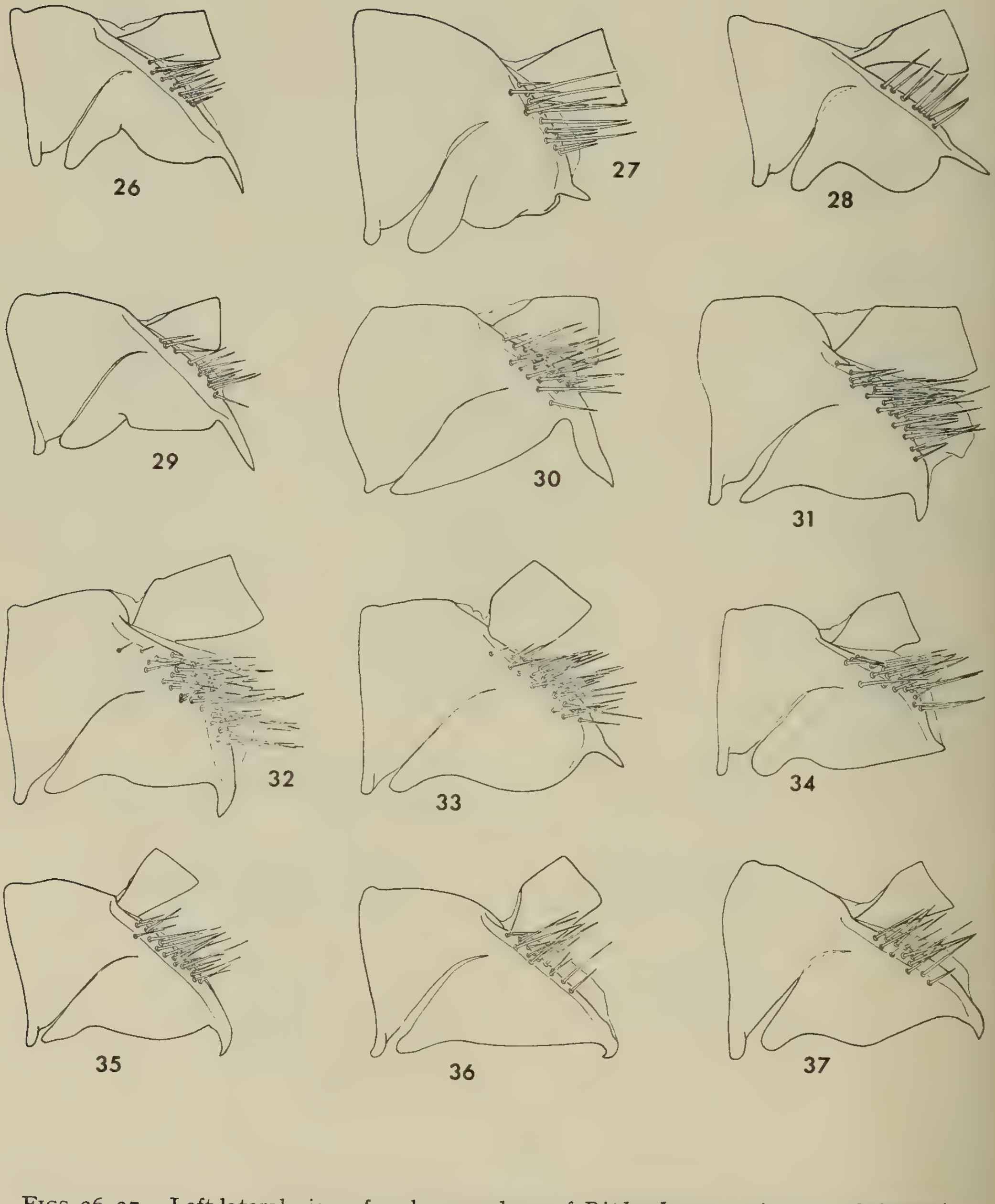
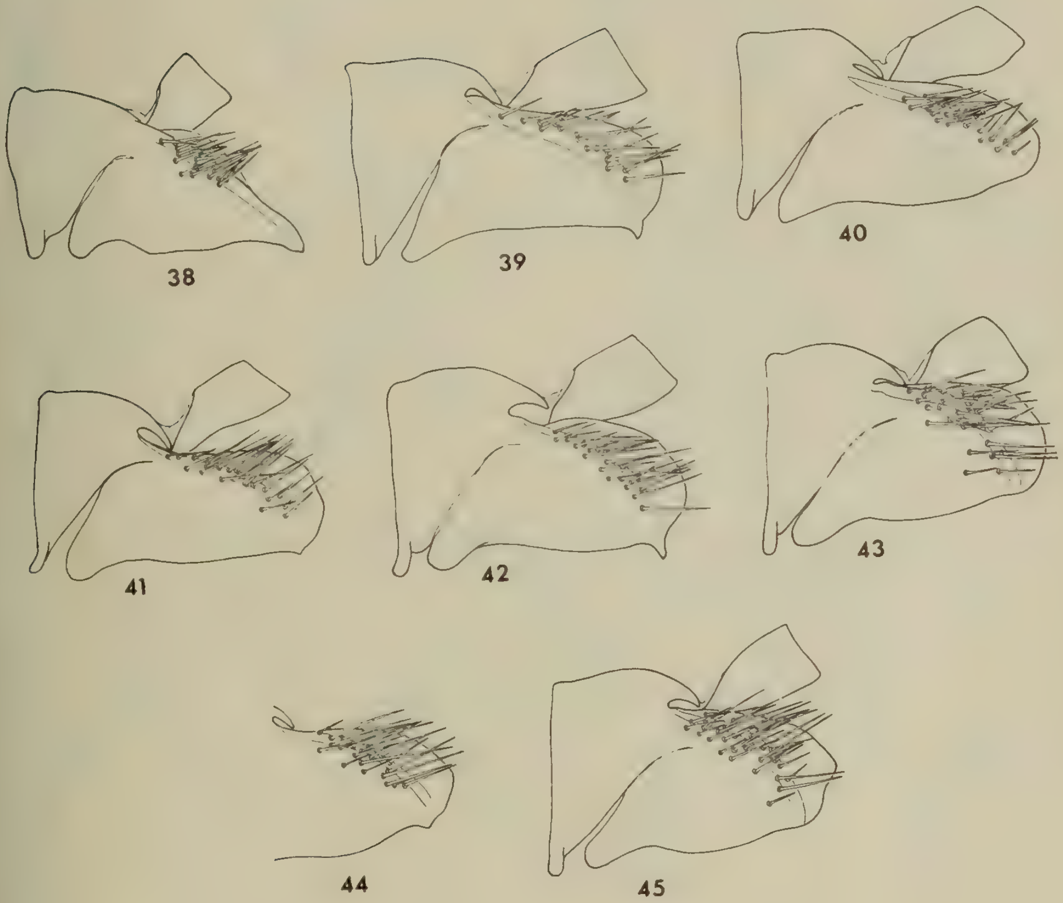
FIGS 7–17. Dorsal view of male pygophore and Xth segment of *Diplocolenus* species. 7, *bohemani;* 8, *configuratus;* 9, *frauenfeldi;* 10, *altaicus;* 11, *nigrifrons;* 12, *alaicus;* 13, *logvinenkoae;* 14, *orientalis;* 15, *limbatellus;* 16, *convenarum;* 17, *quadrivirgatus.*



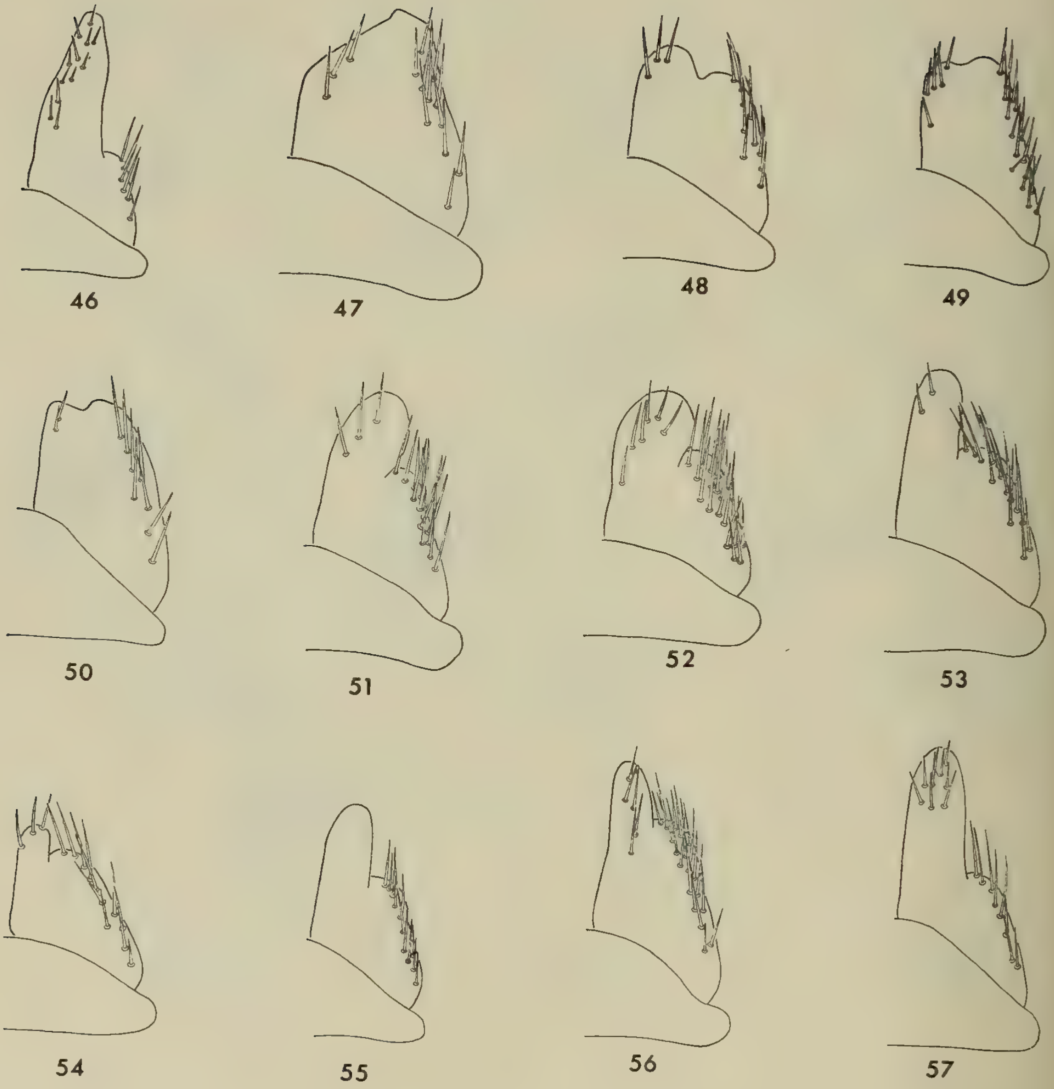
FIGS 18–25. Dorsal view of male pygophore and Xth segment of *Diplocolenus* species. 18, *penthopitta;* 19, *nigricans;* 20, *evansi;* 21, *abdominalis;* 22, *exsiliatus;* 23, *tianshanicus;* 24, *intermedius;* 25, *ciscaucasicus.*



FIGS 26–37. Left lateral view of male pygophore of *Diplocolenus* species. 26, *bohemani;* 27, *configuratus;* 28, *frauenfeldi;* 29, *altaicus;* 30, *nigrifrons;* 31, *alaicus;* 32, *logvinenkoae;* 33, *orientalis;* 34, *limbatellus;* 35, *convenarum;* 36, *quadrivirgatus;* 37, *penthopitta.*



FIGS 38–45. Left lateral view of male pygophore of *Diplocolenus* species. 38, *nigricans;* 39, *evansi;* 40, *abdominalis;* 41, *exsiliatus;* 42, *tianshanicus;* 43, *intermedius;* 44, *oseticus;* 45, *ciscaucasicus.*



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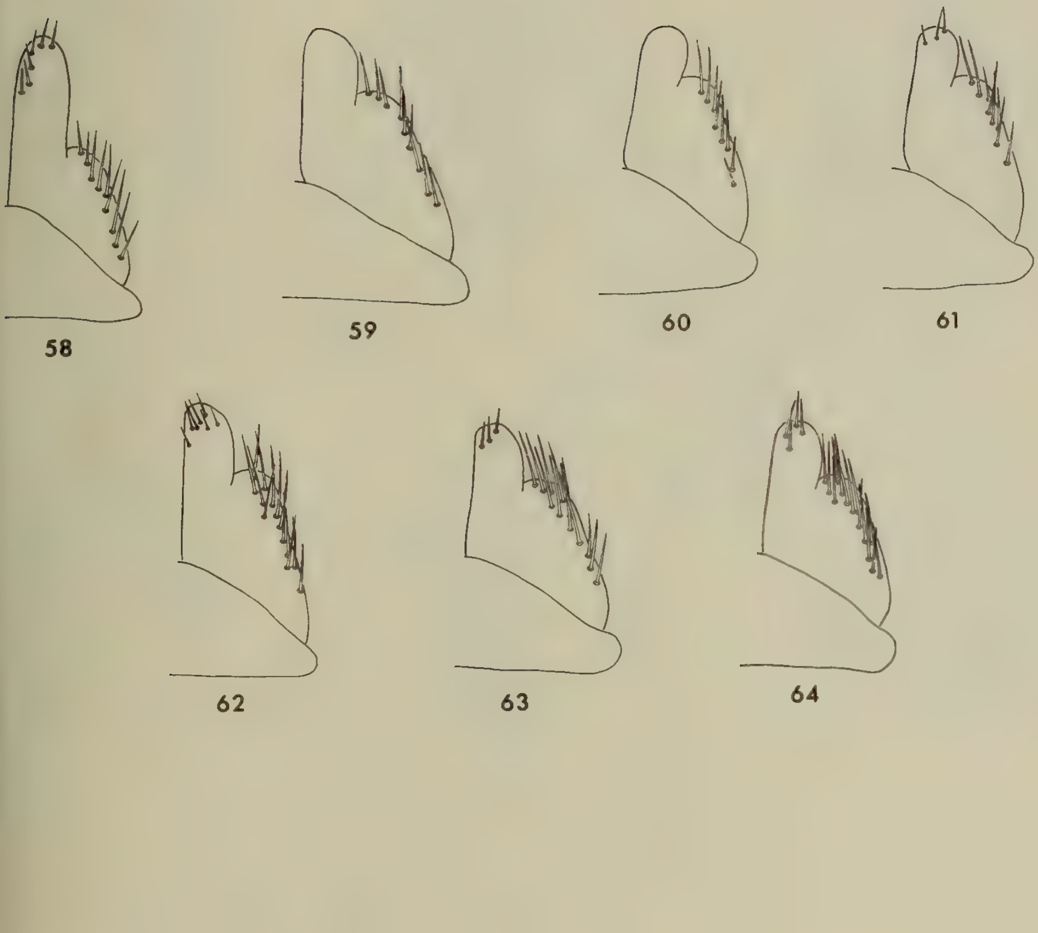

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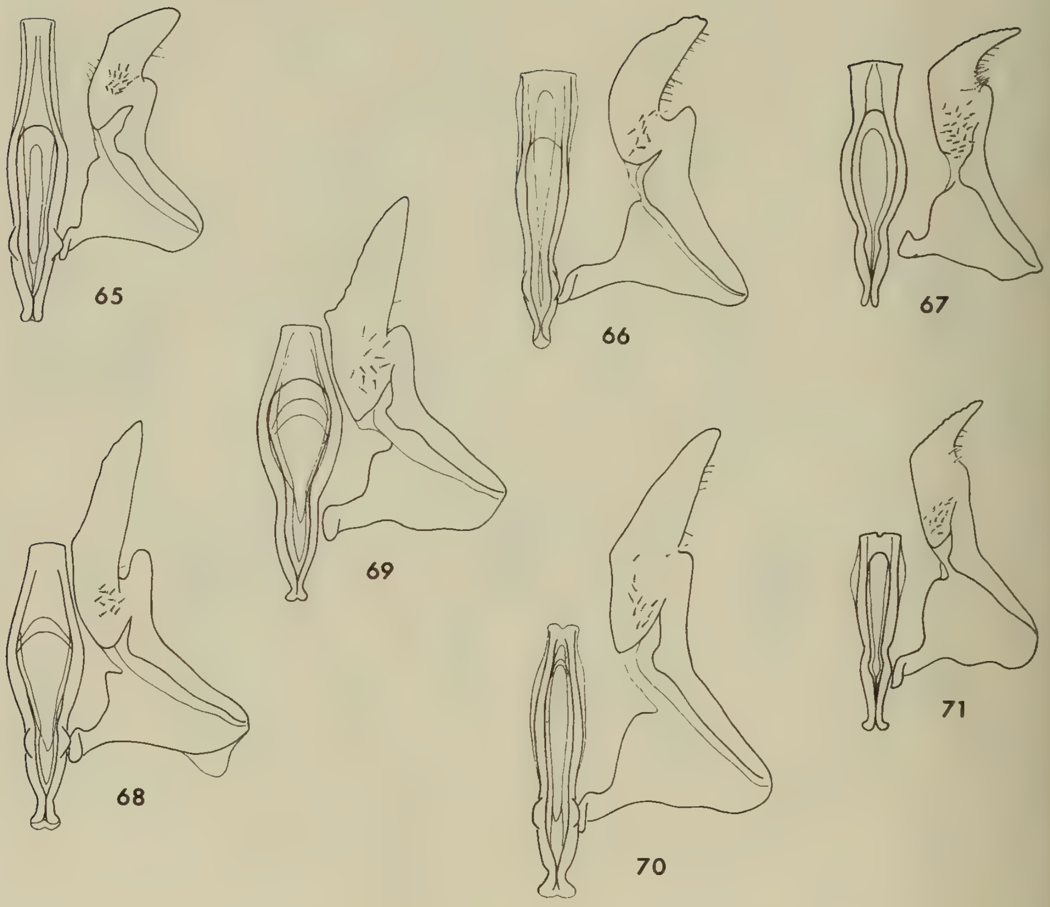

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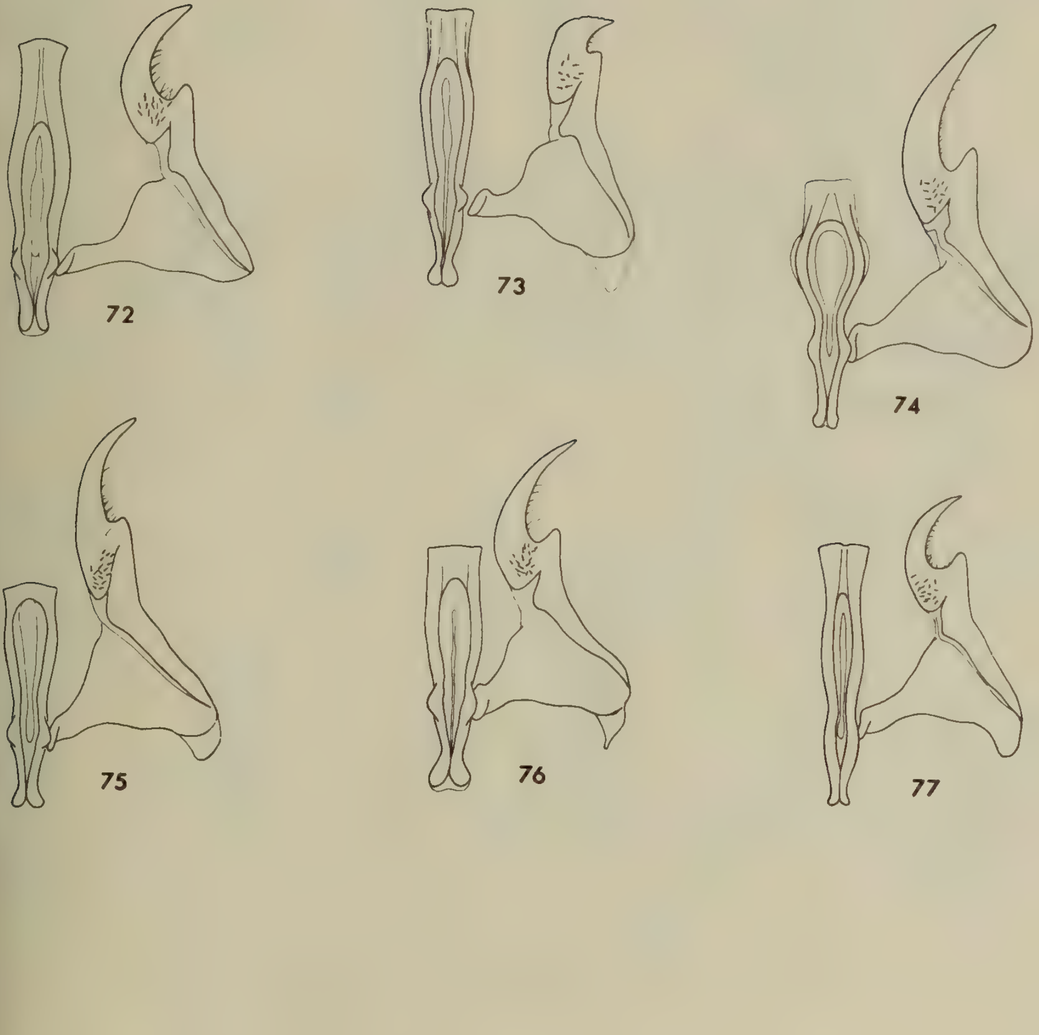

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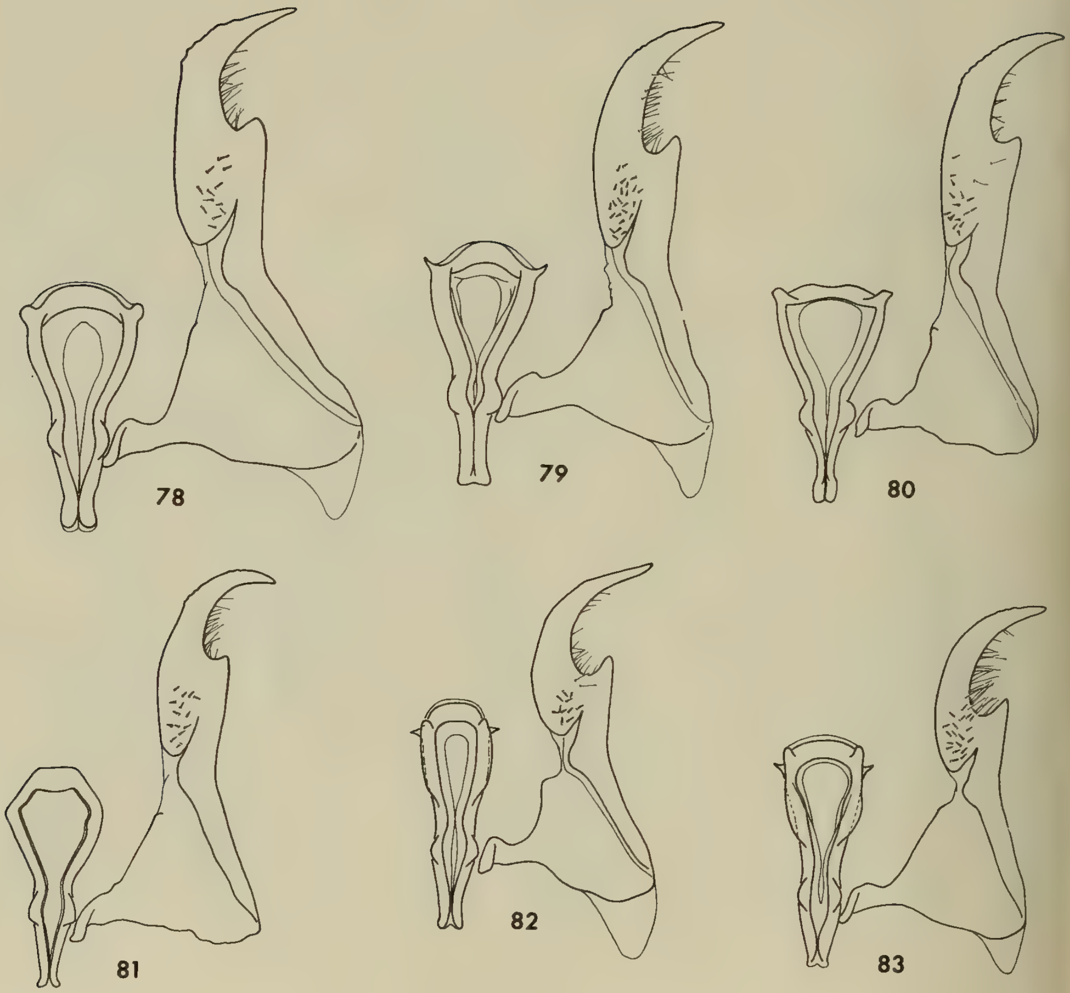

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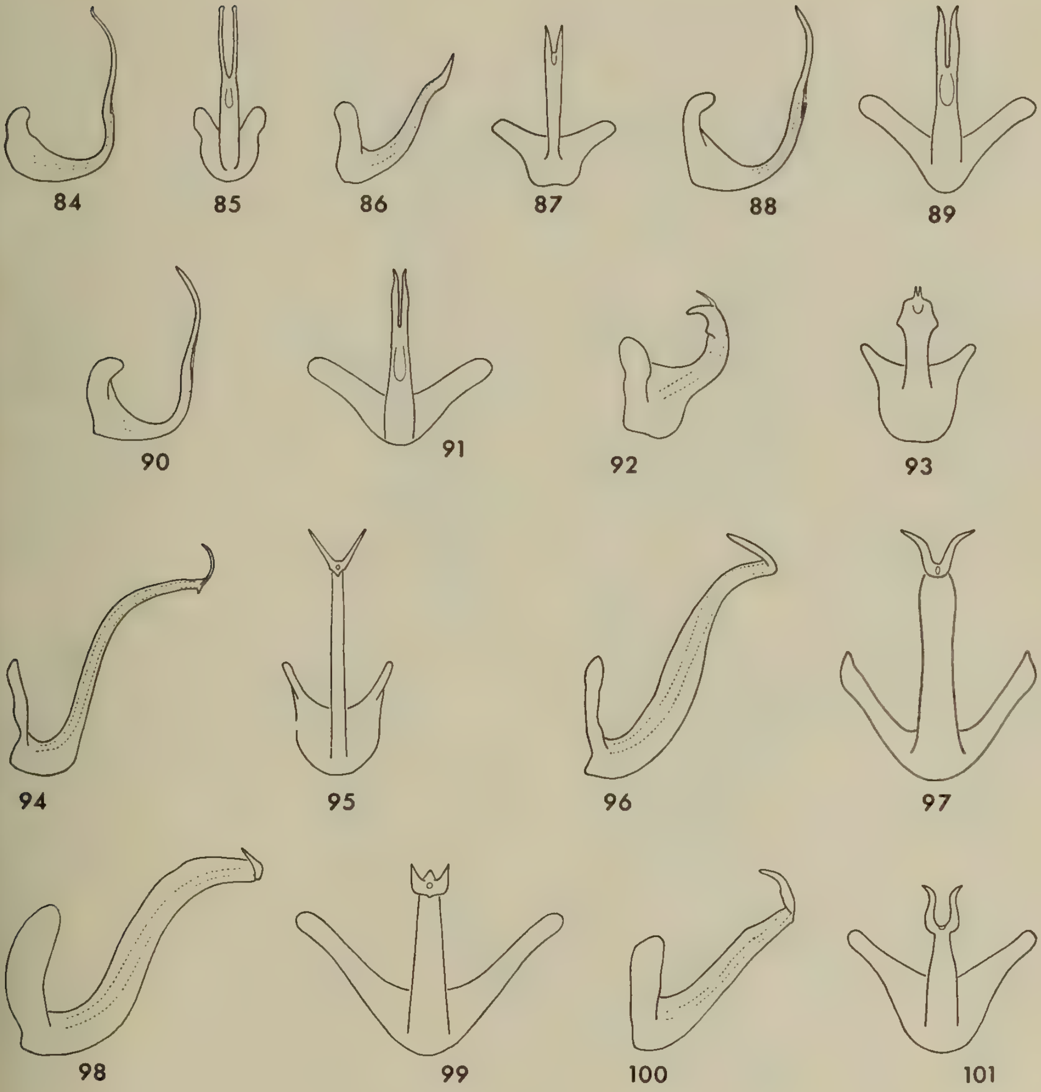
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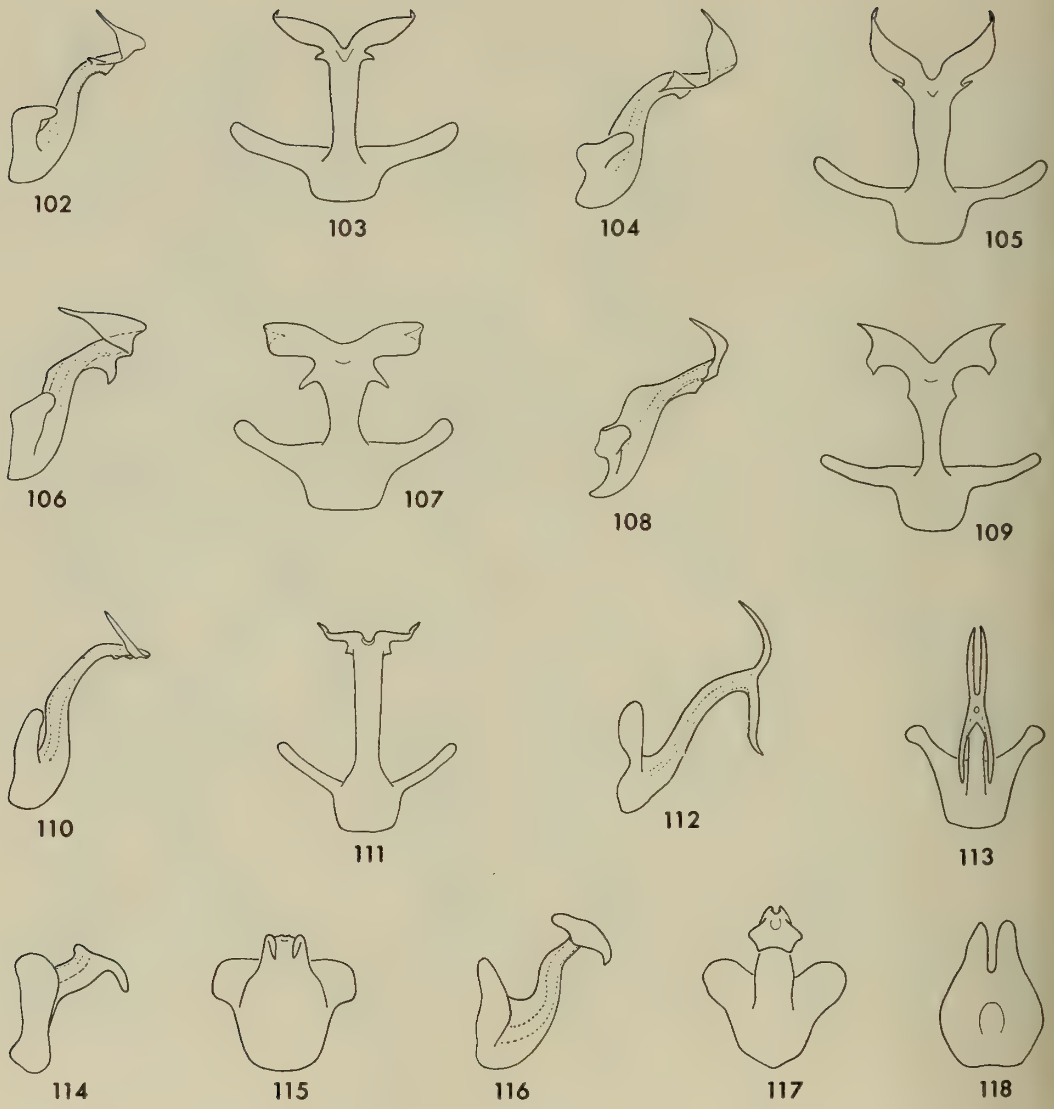
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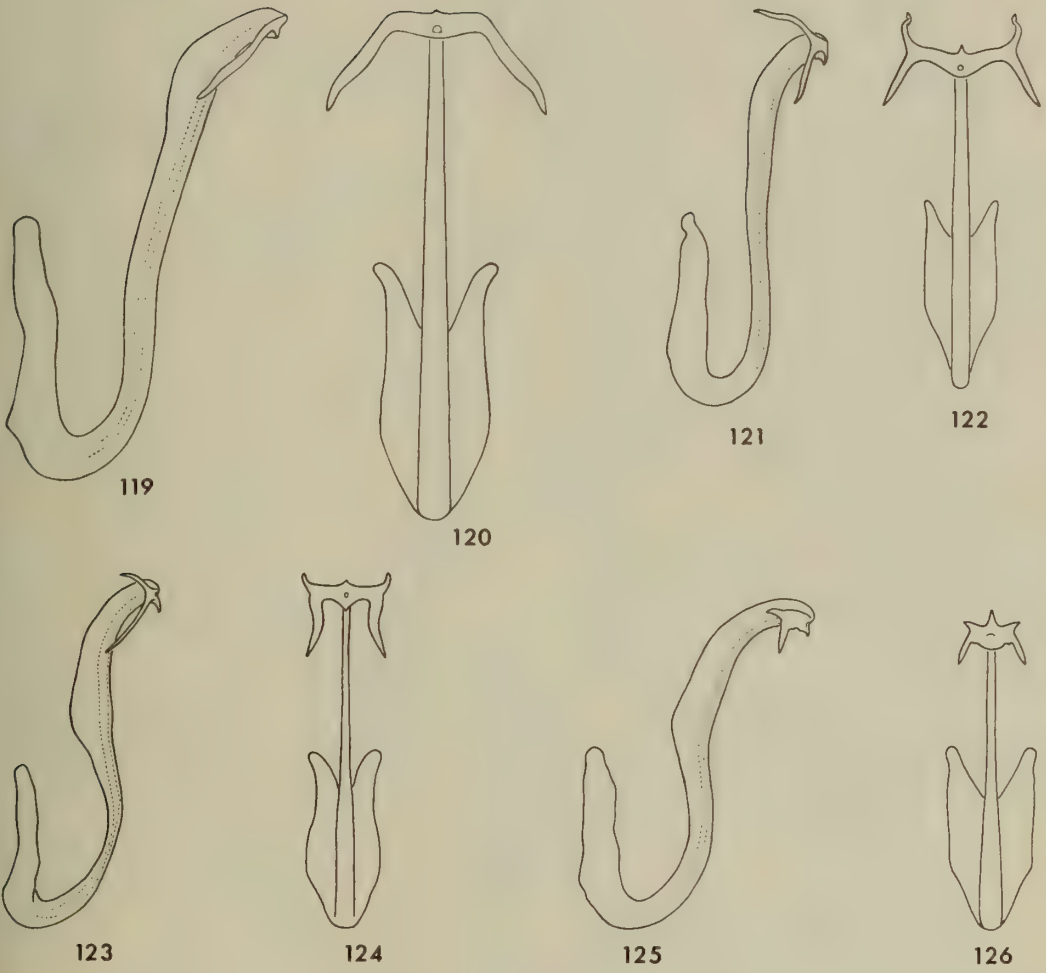
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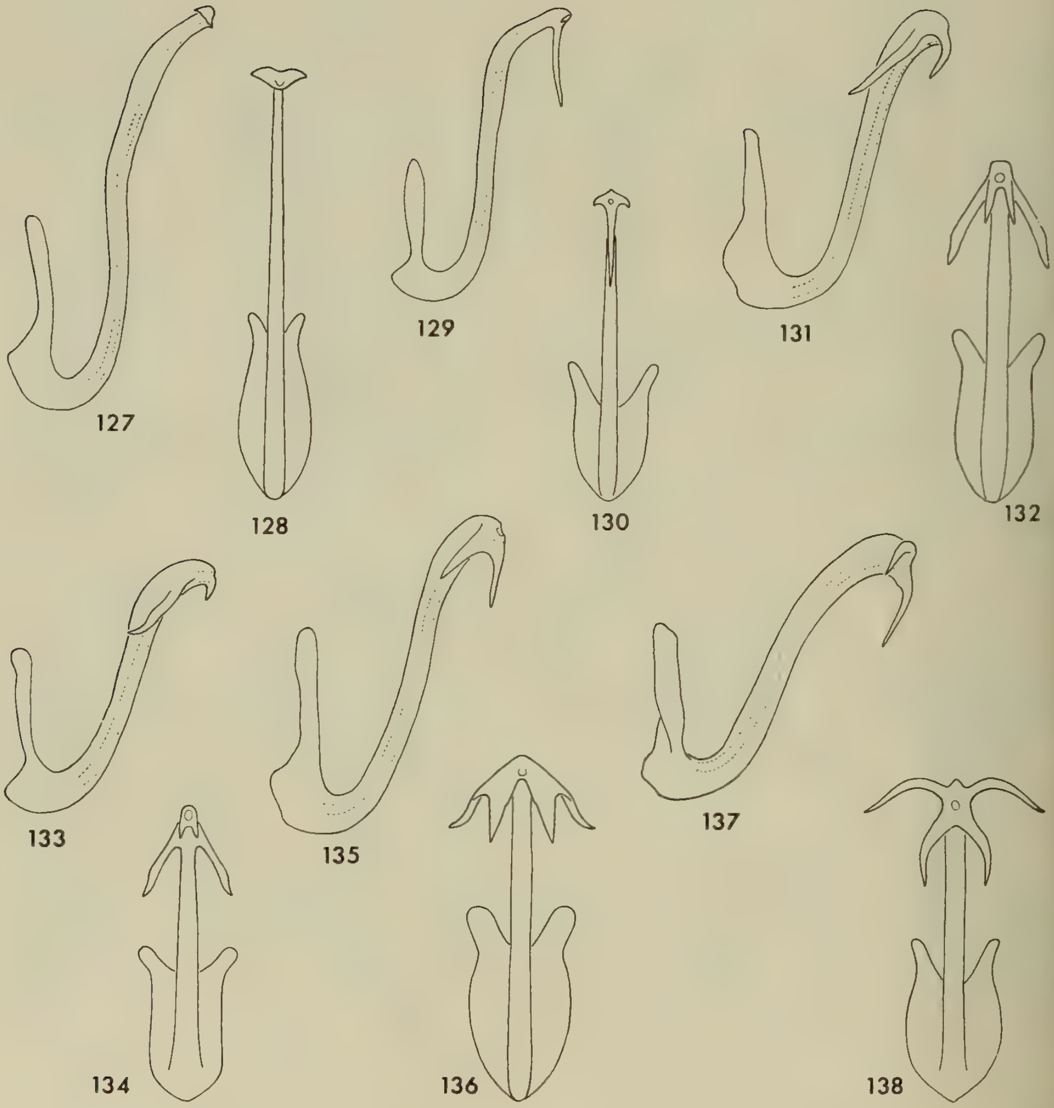
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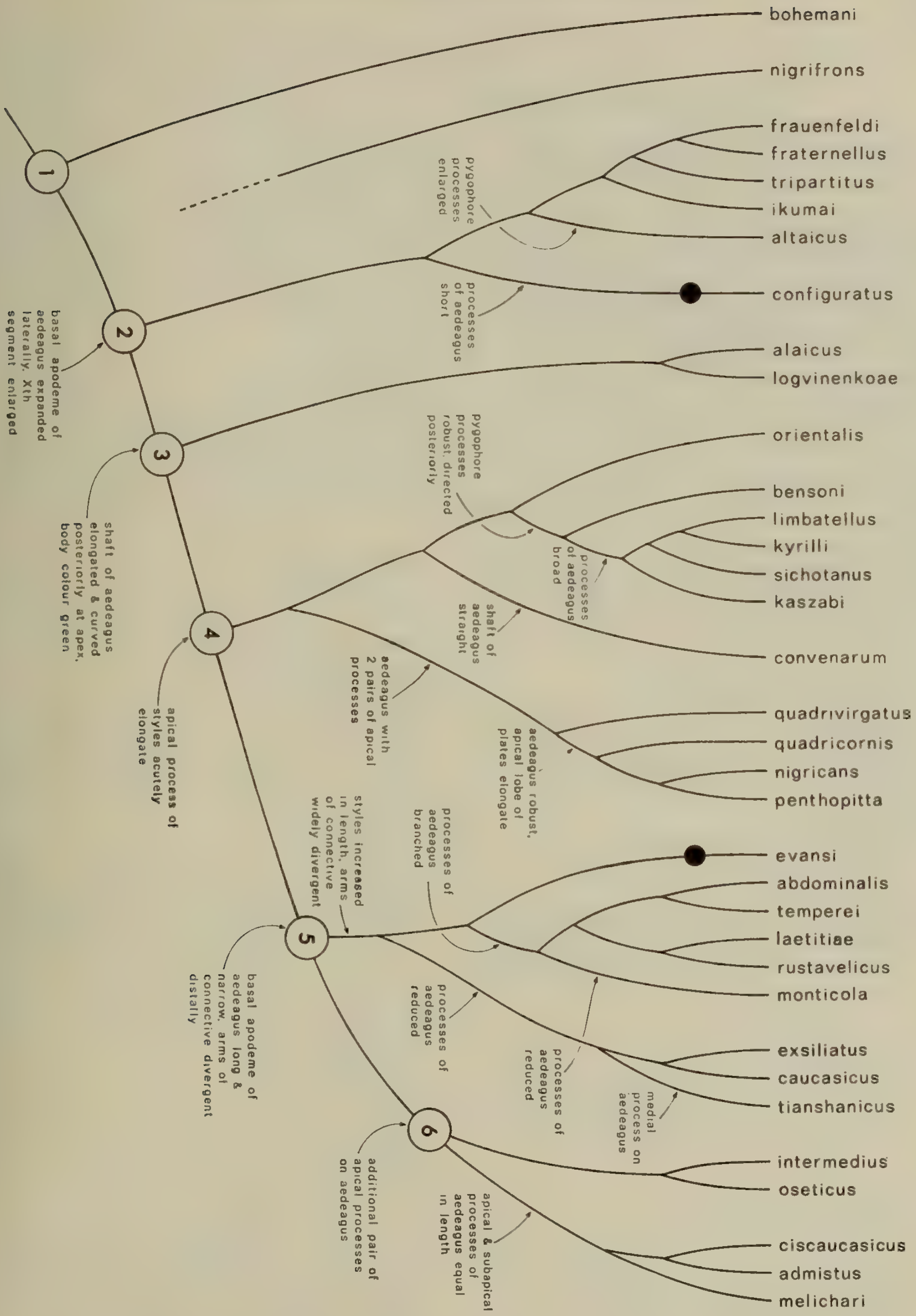
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nigrifrons
frauenfeldi
fraternellus
tripartitus
ikumai
altaicus
configuratus
alaicus
logvinenkoae
orientalis
bensoni
limbatellus
kyrilli
sichotanus
kaszabi
convenarum
quadrivirgatus
quadricornis
nigricans
penthopitta
evansi
abdominalis
temperei
laetitiae
rustavelicus
monticola
exsiliatus
caucasicus
tianshanicus
intermedius
oseticus
ciscaucasicus
admistus
melichari
1
2
3
4
5
6
pygophore processes enlarged
processes of aedeagus short
basal apodeme of aedeagus expanded laterally. Xth segment enlarged
pygophore processes robust, directed posteriorly
processes of aedeagus broad
shaft of aedeagus straight
shaft of aedeagus elongated & curved posteriorly at apex, body colour green
aedeagus with 2 pairs of apical processes
aedeagus robust, apical lobe of plates elongate
apical process of styles acutely elongate
styles increased in length, arms of connective widely divergent
processes of aedeagus branched
basal apodeme of aedeagus long & narrow, arms of connective divergent distally
processes of aedeagus reduced
processes of aedeagus reduced
medial process on aedeagus
additional pair of apical processes on aedeagus
apical & subapical processes of aedeagus equal in length

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# REVISIONAL NOTES ON AFRICAN *CHARAXES* (LEPIDOPTERA : NYMPHALIDAE)

## PART IX

V. G. L. van SOMEREN

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
ENTOMOLOGY Vol. 29 No. 8
LONDON : 1974

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## PART IX

MUSEUM
NATURAL

BY

VICTOR GURNER LOGAN VAN SOMEREN K
The Sanctuary, Ngong, Karen, Kenya

*Pp* 415-487; 18 *Plates*, 9 *Text-figures*

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ENTOMOLOGY Vol. 29 No. 8
LONDON : 1974

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# REVISIONAL NOTES ON AFRICAN *CHARAXES* (LEPIDOPTERA : NYMPHALIDAE)

## PART IX

*By* V. G. L. VAN SOMEREN

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## SYNOPSIS

The above species listed in the Contents and their subspecies are dealt with. Three new subspecies and a new form are described.

## 1. *CHARAXES JAHLUSA* TRIMEN AND ITS SUBSPECIES

### ***Charaxes jahlusa*** Trimen

THIS is a widespread species, extending from the Cape, up the east coast of Africa to southern Ethiopia. It has been divided into some four races which can be upheld but, as with many other bushveldt species, one race may merge with the next if suitable environment connects the two main habitats. Such intergrades do not, in my opinion, invalidate the status (as good races) of the two extremes, each aggregate remaining true to type within its main habitats.

A study of a vegetational map of Africa, such as that produced by UNESCO, 1959, shows that bushveldt or acacia savannah stretches the whole way from the Cape to southern Ethiopia, in a varying degree. It must be recognized, however, that there is a change in ecological conditions, such as temperature and humidity, as one approaches the Equator, and the effect of the two monsoons, producing the two 'rainy seasons' in eastern Africa, cannot be ignored.

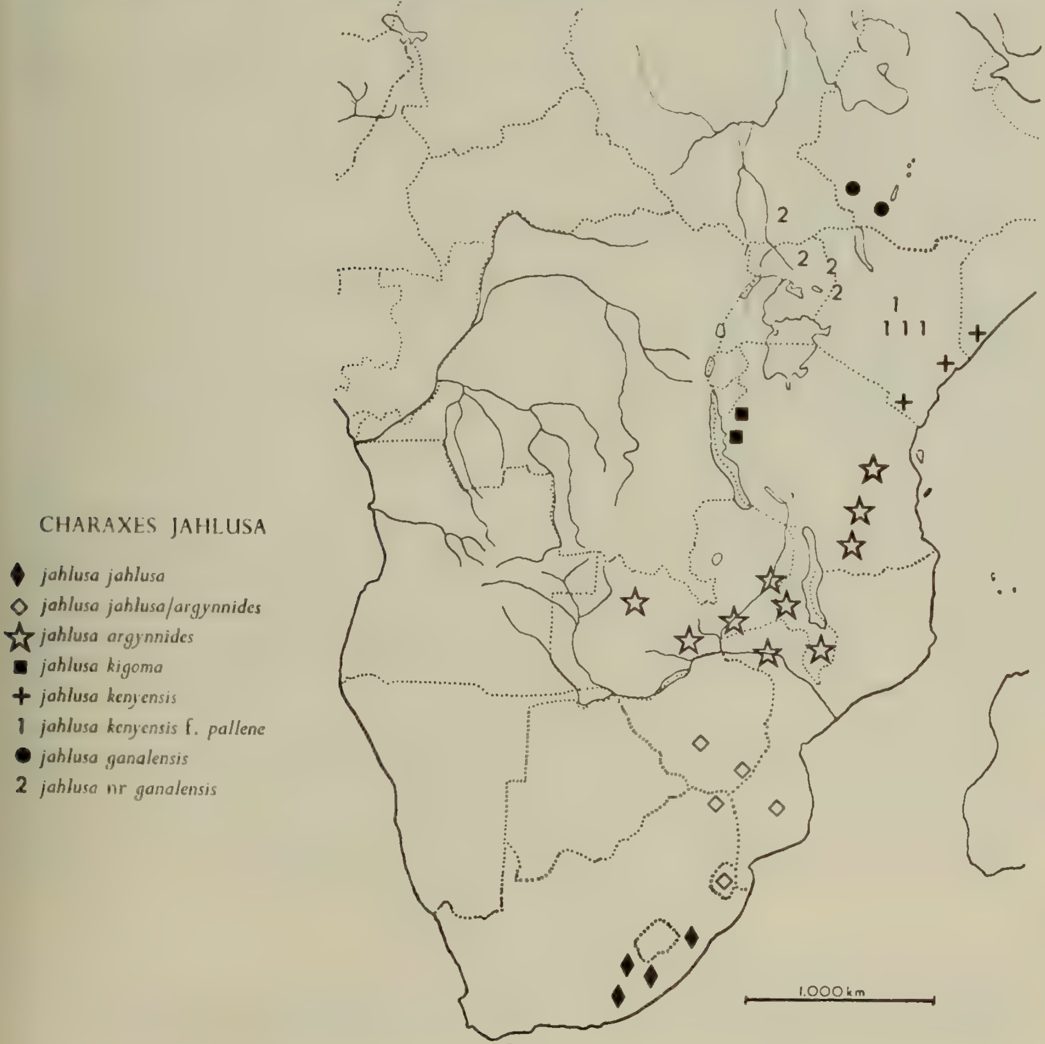
### ***Charaxes jahlusa jahlusa*** Trimen

(Pl. 1, figs 1–5, Map 1)

*Charaxes jahlusa* Trimen, 1862 : 177, n. 102.

MALE. Fore wing length 23–27 mm. In shape, costa only slightly curved, but apex produced, enhanced by the strong concavity on the outer margin of the wing in region 3–5 and the prominent hind angle in 1a–1b. *Upperside.* Ground colour of both wings buffish orange, shading to buff on the inner fold of the hind wing. Pattern of black spots bold, arranged as follows: a small black dot at base of cell, followed by a linear mark at about mid point, and a larger L-shaped mark at its end; two rounded spots in the sub-bases of 1b & 2, a series of more linear black marks in the discal line, that in 1b round; the border of the wing, including the apex brownish black, carrying a series of pale orange spots, that in 6 large and sometimes whitish; margin with a series of orange linear marks, becoming larger and more rounded toward the hind angle, these marks may sometimes dominate the border, leaving only a narrow chain of conjoined black lunules proximally (cf. female). Hind wing, upper margin paler than the rest of the wing, with a large, somewhat quadrate black spot in the subcosta and below this a smaller spot, sometimes double, at the end of the cell; the cell may have a pale rounded spot in the middle; the border of the wing with a series of black spots with orange enclosed distally abutting on to the orange margin; edge of wing black. Some specimens show a series of faintly indicated black lunules on proximal side of the row of dark submarginal spots. *Underside.* More strongly patterned than the upper; fore wing ground colour greenish grey along the base of the costa and beyond the cell, shading into the delicate pinkish buff of the rest of the wing. A black spot on the base of the costa; black spot in the disc of the wing slightly smaller than upperside, but showing up strongly on the paler ground. The submarginal dark line showing up well, with an extension to the margin in 5 and less strongly at ends of veins 1–3, the dark line distally edged with whitish from 3 to apex, the marginal spots at the hind angle buffish pink; the border above to apex greenish grey with faintly indicated buffish marks on the margin. The whitish mark at the base of the subapex is satiny. Hind wing, ground colour satiny, base of wing with a brownish grey patch with irregular distal edge, margined in black, broken by a strong satiny white spot at base of 8, followed by three smaller spots in sub-bases of 2 and the cell. The inner fold with two black spots; the border of the wing with an intricate pattern of buffish lunules, separated from the submarginal buffish ovoid spots by a zone of greenish grey, ending at the anal angle with two spots on a greenish ground; the edge slightly ochreous with blackish line distally. There are two black spots on the inner fold and black lunules in the subapex of 1b & 2. The two sharply pointed tails, 3 & 2 mm in length on veins 2 and 4, are orange on the upper side, blackish below.

FEMALE. Both wings differ in shape from that of the male, the fore wing is less falcate and the hind wing more rounded, less pointed at the anal angle. *Upperside.* The colour of both wings is paler tawny orange; the dark spotting of the fore wing, arranged as in the male, is thus more clearly defined; the marginal orange more extended and reducing the width of the submarginal dark spots to lunules. On the hind wing the basal black spots are not so strong, but the row of black spots, with orange distally, is more clearly defined, and the orange border wider; the edge black. The tails are better developed and of about equal length, 4–5 mm. *Underside.* Fore wing paler than in male, the pinkish area less strong. The dark spotting corresponds to that of the upper side. The hind wing ground colour paler than in male, the basal and submarginal marks as in male but less strong; the submarginal border wider, but the whitish spots and the discal zone satiny.


CHARAXES JAHLUSA
◆ jahlusa jahlusa
◇ jahlusa jahlusa/argynnides
☆ jahlusa argynnides
■ jahlusa kigoma
+ jahlusa kenyensis
1 jahlusa kenyensis f. pallene
● jahlusa ganalensis
2 jahlusa nr ganalensis
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1.000 km

MAP 1.

RANGE. Cape Colony of South Africa, mainly in the eastern areas, extending toward Natal in a transitional form which is unstable. These intermediate forms also occur in southern Mozambique and the southern part of Rhodesia, where they tend more strongly toward *argynnides* (Pl. 1, figs 4 & 5).

### ***Charaxes jahlusa argynnides*** Westwood

(Pl. 1, figs 6–9, Map 1)

*Charaxes argynnides* Westwood, 1864 : 10.

MALE. Fore wing length 25–27 mm; shape as in nominate race. *Upperside*. Fore wing, ground colour very similar to nominate *jahlusa*, though slightly variable as to depth of orange colour. Black spots in median and submedian areas, including the subcostal and cell, slightly smaller, but the marginal black border stronger, with a reduction in the size of the marginal orange spots; the spot in the subapex not pale but the same colour as the ground, this also applies to the orange spot in the subcosta. Hind wing ground colour as fore wing, the costal black spot smaller, often divided into two dots; the black spot at the apex of the cell small, or lacking. The marginal black border narrower, with a reduction of the dark zone on the proximal side; the admarginal orange spots smaller and the black edge narrower. Tails as in nominate race. *Underside*. Fore wing, pinkish buff area darker. The black spots as on the upper side; the silvery subapical costal mark strong, though smaller than in the nominate race; the submarginal dark zone wider, and the silvery mark in the apex and 'bay' of wing less well marked, more greyish. On the hind wing the basal dark patch is darker, more brownish, the silvery costal spot and those on the distal side of the patch, though smaller, are strongly outlined in black. The border is broader and duskier, the large silvery spot at the upper angle is missing or only slightly indicated; the submarginal row of lunules are darker, with dark lines proximally, directed toward the silvery bar; the admarginal row of whitish, black-edged lunules are strong, especially in the region of the tails. Edge of wing orange or dusky orange.

FEMALE. Fore wing length 30–32 mm. Shape, apex of fore wing less falcate than in male, thus more rounded, hind wing also more rounded. *Upperside*. Fore wing, ground colour paler, as a rule, than in the nominate race, the black spots of about the same size or reduced; marginal black lunules strong, though often reduced in size. Hind wing ground colour as in fore wing, the discal dark spots reduced in size; the submarginal lunules with pale spots distally lightly narrower though well marked. *Underside*. Compared with the nominate race, ground colour paler; the dark area at base of wing less strong, more chocolate-brown, but the white spots within and on the margin, though smaller, are distinct; the postdiscal zone is pale chocolate-brown; the submarginal row of dark spots less broken up; the white marginal lunules, outlined in black, more distinct. Tails longer than in the male, very thin, 5 & 4 mm long.

RANGE. The region of the Zambesi River; the northern parts of Rhodesia, adjoining Mozambique, Zambia, Malawi and southern Tanzania.

### ***Charaxes jahlusa kenyensis*** Joicey & Talbot

(Pl. 1, figs 10–16; Map 1)

*Charaxes jahlusa kenyensis* Joicey & Talbot, 1925 : 646.

There are two ecological forms, that of the Kenya Coast littoral, and that of the dry savannah area around Kibwezi.

Nominate *kenyensis*

MALE. Fore wing length 28–30 mm. Shape as in nominate *jahlusa*, or even more falcate. *Upperside* fore wing, ground colour rich rufous orange; black spots as in the nominate race, but subcostal ones more developed; black border, including the apex, blacker, with a reduction in size of the subapical orange spot and of the marginal orange spots. Hind wing, ground colour as fore wing, costal black spot, though reduced in size, often strong. The dark patch of the underside shows through slightly; the black border narrower than in nominate *jahlusa*, but denser, the orange lunules well marked only in the region of the tails; the orange border narrow from vein 5 to anal angle, which is greenish. Tails rather short, upper 3 mm, lower 5 mm, with base conjoined to the upper side of anal angle. *Underside*. Ground colour at base and disc of wing strongly pink, shading to more greyish in cell, subcosta and beyond to apex. Pattern of black spots as above; a slightly quadrate silvery spot at end of cell and similar silvery ones in sub-bases 5–7, with some silvery shading distal to the black spots in 2–3; apex with two elongate ovoid silvery marks. Submargin with a double row of blackish marks, the inner linear, from which blackish linear marks in interspaces are directed inward, most marked in the apex, the outer row more angled and enclosing pink to whitish marks. The marginal spots pinkish, most marked at the tornus, divided by greyish; edge finely white. Hind wing, basal dark areas reduced and rather broken up but strong and clearcut, the silvery subcostal spot large, those in the cell also clear; the postdiscal zone and the inner fold silvery, crossed by dark lines along the veins and interspaces; lower part of fold with two black lunules, above the hind angle. The border is dark but has the same intricate pattern of black-edged lunules with brownish centres and white-centered admarginal lunules as noted in the nominate race; the dark border interrupted by a large silvery patch at base of upper tail, with smaller spots at upper angle; the outer row of marks with narrow greenish surround most marked at the anal angle; the edges light brownish to greyish.

FEMALE. Fore wing length 32–35 mm. *Upperside*. Ground colour of both wings tawny orange, the pattern of black spots as in the male but more developed, those along the subcosta strong, the interspaces toward the apex, paler orange-tawny; the border is blackish, more solid at the apex, the conjoined lunules with strongly marked orange marginal spots. Hind wing ground colour rufous orange, slightly paler in the disc, the dark patch of underside showing through slightly and the discal dark spots, though small, are clear; the paler line beyond shades into the darker orange, which carries a faint indication of darker lunules; the conjoined submarginal lunules, with orange distally, are well defined; the margin orange, with narrow dark edge. Tails moderately long, 5 & 4 mm, orange with black borders. *Underside*. Fore wing ground colour as in the male, black and silvery marks similarly arranged but marginal border wider, though not so defined, and enclosing ochreous triangles outlined distally in black, more solidly black at the hind angle; border beyond greyish to pinkish at the hind angle. Hind wing basal area as in the male, the silvery band beyond narrower, but the submarginal zone broader, with the double row of marginal lunules better developed. The silvery triangle above the anal angle almost discrete and well marked.

RANGE. Kenya and adjoining Tanzania, along the coast littoral to the Somali border; extending inland to the Voi area and the Teita Range.

The nominate form of this subspecies is replaced in the drier savannah country by a small ecological variant, whose males differ from the nominate coastal race *kenyensis* by being much smaller, and with an equally small and very pale female.

## Form ***pallene*, forma n.**

(Pl. 1, figs 12–15, Map 1)

MALE. Fore wing length 23–25 mm, thus about the size of nominate *jahlusa*. Shape as in the nominate race, sometimes less falcate. *Upperside*. Ground colour duller, more tawny than *kenyensis*, the black spots bolder, those of the subcosta tending to be confluent; the apical and black of the border heavy; the subapical tawny spots reduced in size, the marginal ones small except at the hind margin. Hind wing ground colour as fore wing, costal area paler, the costal black mark strong, and the underside dark patch showing through slightly. The hind wing border of black and orange spots narrow, but the marginal orange border well marked. The tails are very short, 2 & 3 mm. *Underside*, generally duller, the pinkish area more buffish and restricted to the hind margin of the fore wing. The black spots much as on the upperside but the apical and subapical pale marks more confluent, the submarginal border strong. On the hind wing the basal dark patch is more solid and darker than in *kenyensis*, but the contained white spots are distinct. The pale zone is more defined on the proximal side and is rayed with black, as also is the inner fold, which has double black lunules above the white triangle above the anal angle. There are two strong black spots on the inner side of the fold. The border is of the same complicated pattern noted in other races.

Female. It is this sex which exhibits the greatest difference from that of other races. Fore wing length 25–28 mm. *Upperside*. Ground colour of both wings dull ochre, the black spots on the fore wing bolder and well developed; the marginal black loops bolder; the two paler marks in the subapex and costa extend into cellule 3. The marginal spots paler. Hind wing, ground colour has a faint trace of the dark basal marks of underside; the costal spot at end of cell as in *kenyensis*, as also are the marginal series of black and ochreous spots. Tails comparatively short, 3 & 4 mm. *Underside*. Fore wing ground colour ochreous, without the usual characteristic pinkish in the lower half of the wing; this area is buff, shading to greyish on the costa and margin. The black spots are strongly developed; hind wing dark basal area, though not very dark, is well defined, the contained costal spot is only slightly silvery, those on the edge of the patch are whitish, not silvery, and are bordered by a zone of brownish adjacent to the intricate patterned marginal border; this zone, as well as the inner fold, crossed by dark lines on and between the veins; the mark above the anal angle is slightly silvery.

Holotype male. Kenya: Kibwezi (Kibezi), W.F., iii. 1932 (*van Someren*).

Allotype female. Kenya: Kibwezi, W. F., iii. 1930 (*van Someren*).

Holotype, allotype and paratypes in BMNH.

Range. The dry thorn-bush country around Kibwezi and Ukambani and upper Tana River, and Northern Uasso-Nyiro River.

### ***Charaxes jahlusa*** near ***ganalensis*** Carpenter

(Pl. 1, fig 16; Map 1)

Male. *Upperside*. Carpenter (1937 : 64) describes the male of ssp. *ganalensis* as 'very like that of *kenyensis* in the black markings of the apical part of the fore wing and in ground colour, but the apical black is not so pronounced. . . .' In the specimens from Suk and Karamoja, Uganda, the apical black is strong and continuous with the black border, the subapical spots are small, the marginal spots are obscured. On the hind wing, the dark basal area of underside shows through and the spot on the costa is strong. The marginal border is narrow and the admarginal linear marks obscured, the edge only slightly orange. *Underside*. Carpenter states 'on the *undersurface* the general effect is much more uniform than in other races, with the different elements of the pattern less strongly contrasted'. In the Suk examples before me, the pattern is strong; on the forewing the pink area occupies the whole of the hind half of the wing, shading into greenish grey at the costa, and greyish toward the apex; the silvery white streaks with black spots at base in the subapex are strong, and the two in the submarginal line equally strong; the darker border has orange linear marks outlined in black; the margin with greyish ground has orange spots, strong at the hind angle. On the hind wing the basal dark patch is blackish grey, greenish grey at the costa, which has three black dots; the subcostal silvery white oval spot is strong as is also the silvery bar distal to the patch and goes through to the inner fold; this is followed by a greyish zone divided up by blackish lines along and between the veins arising from black bases with orange distally, forming part of the intricate border which is interrupted opposite the upper tail by a greenish grey patch; the margin is usually brownish but in some specimens is also greenish grey.

The Suk-Karamoja examples do not conform to the description of *ganalensis*, of which, unfortunately, I cannot obtain specimens.

RANGE. Kenya-Uganda border in the Suk and Karamoja country west of Lake Rudolf, which is dry savannah country, mostly thornbush.

### ***Charaxes jahlusa ganalensis*** Carpenter

*Charaxes jahlusa ganalensis* Carpenter, 1937 : 64.

No specimens available.

### ***Charaxes jahlusa kigoma*** **subsp. n.**

(Pls 1 & 2, figs 17–20)

*Charaxes jahlusa argynnides* Westwood; Carcasson, 1966 : 21.

A series of three males were taken in the Mukuyu district of the Kigoma area by the Japanese Primate Expedition to N.W. Tanzania. Additional material, including females, was collected by Major Grahame's African collector, in the same area; they differ considerably from *argynnides* of the Zambesi area. This race is larger than any other and is the most decorative.

MALE. Fore wing length 38–40 mm. *Upperside.* Ground colour a rich rufous orange, darkening slightly toward the base and along the costa; the black spots in the cell at distal end strong, the two often confluent; the spots at the sub-bases 1b–2 small, those in the discal line larger, but still smaller than in other races, the apical portion and the border of the wing almost uniformly black, but the orange spots in the subapex present, though small; the marginal orange spots almost obliterated except those at hind angle. The hind wing colour equally rich tawny orange, very slightly paler along the costa, where the costal black spot is relatively small; the border black with a few orange spots in the admargin in the region of the tails; the admargin orange but not extending up to the upper angle. Tails rather short, 2 & 3 mm in length, mostly black. *Underside.* Fore wing, base and the greater part rich tawny orange, more greyish along the costa, which has a greenish tinge; the apex of the wing with a brownish sub-basal bar with an extension to the margin and continued down the submargin, which is greyish in the 'bay' of the wing; the silvery streaks in the subapex and those beyond strong, the latter with greyish rays to the margin. The border strong, the latter with greyish rays to the margin. The border of the wing blackish toward the hind angle, which carries an orange double spot in 1b. Hind wing costa olive-greyish at base; dark greyish basal patch strong, extending to inner fold to two black spots; silvery subcostal spot well marked, that in cell also very distinct; outer side of patch bordered by an irregular silvery bar ending above the anal angle white triangle, with two black dots above, this zone merging with the more brownish submarginal zone, both crossed by black veins and shorter black lines interneurally; border dark, with a silvery spot in upper angle, followed by smaller orange spots and lunules outlined in black; the margin with paler spots also outlined in black, with some greyish green around; edge brownish orange.

FEMALE. Fore wing, length 34–36 mm, less falcate than the male, hind wing more rounded. *Upperside.* Fore wing, ground colour rich tawny orange; subcostal black spots large, as also are those in the sub-bases of 1b & 2 and those in the discal line. The dark marks in the subapex sagittate, with bases on the four orange spots in subapex; apex and border of wing brownish black, the orange marginal linear marks small, except the double spot in 1b. Hind wing ground colour tawny orange, slightly paler along the costa; the dark patch of underside showing through slightly; the costal black spot small. The submarginal lunules hardly visible; the black border with orange spots strong; marginal line orange, edge black; tails rather short, 3 & 4 mm in length, orange with black edges. *Underside.* Fore wing, ground colour mainly a rich tawny orange, this colour extending from the hind border to end of cell and vein 4, gradually shading into the olive-grey of the base of the costa and the ochreous grey of the rest of the wing, with an extension to the margin in vein 5. Costa with a black spot in sub-base, remaining black spots as above and equally strong; the ochreous bar at the sub-bases of 5–7 moderately well marked, those in subapex stronger, with greyish rays extending to the margin; the dark submarginal line weak except toward the hind angle, where the marginal spots are orange; edge black. Hind wing, basal patch tawny brown, the black spots at costa and black line on outer border well marked, as also are the silvery white subcostal mark and that in the cell; the silvery bar on distal side strong, connecting at its end with the silvery triangular mark above the anal angle; inner border of fold with two black spots and a black line above the silvery triangle; on the distal side of the silvery bar is a buffish brown zone and both are crossed by black veins and interneural lines which extend from a series of black-bordered orange triangles, the spot in 7 is large and silvery white; the border is ornamented with a series of black-ringed, silvery marks, most developed at the upper angle; the margin of the wing is orange, whitish at upper angle; edge black, the anal angle slightly olive. Tails orange with black edges.

Holotype ♂. TANZANIA: Kigoma, Mukuyu, x. 1964.

Allotype ♀. TANZANIA: Kigoma, x. 1964.

Both in the collection of Major Iain Grahame, to be deposited in the BMNH.

Paratypes in Coll. Grahame.

RANGE. At present known only from the type-locality.

## SYSTEMATIC LIST

### ***Charaxes jahlusa*** Trimen

*Charaxes jahlusa jahlusa* Trimen, 1862. Type locality: Grahamstown, Bashee River, Cape, South Africa.

Range: Southern Africa, eastern Cape with a transitional form to *argynnides* in Natal, Transvaal, southern Mozambique and southern Rhodesia.

*jahlusa argynnides* Westwood, 1864. Type locality: 'Zambesi'.

Range: Zambesi River, Zambia, northern Rhodesia, Malawi, northern Mozambique, southern and eastern Tanzania.

*jahlusa kigoma* subsp. n. Type locality: Kigoma, Tanzania.

Range: District to the north-east of Lake Tanganyika in Kigoma area.

*jahlusa kenyensis* Joicey & Talbot, 1925. Type locality: Mombasa and Teita Hills.
Range: Kenya coast and hinterland to Tana River; Taveta-Kilimanjaro area.
*jahlusa kenyensis* f. *pallene* forma n. (Ecological form No. 1).
Range: Kibwezi and adjacent Ukambani.
*jahlusa kenyensis* f. transitional to *ganalensis* (Ecological form No. 2).
Range: Suk and Kamasia to Turkana.
*jahlusa ganalensis* Carpenter, 1937. Type locality: Ganal River, Sidamo, south-western Ethiopia
Range: south-western Ethiopia.

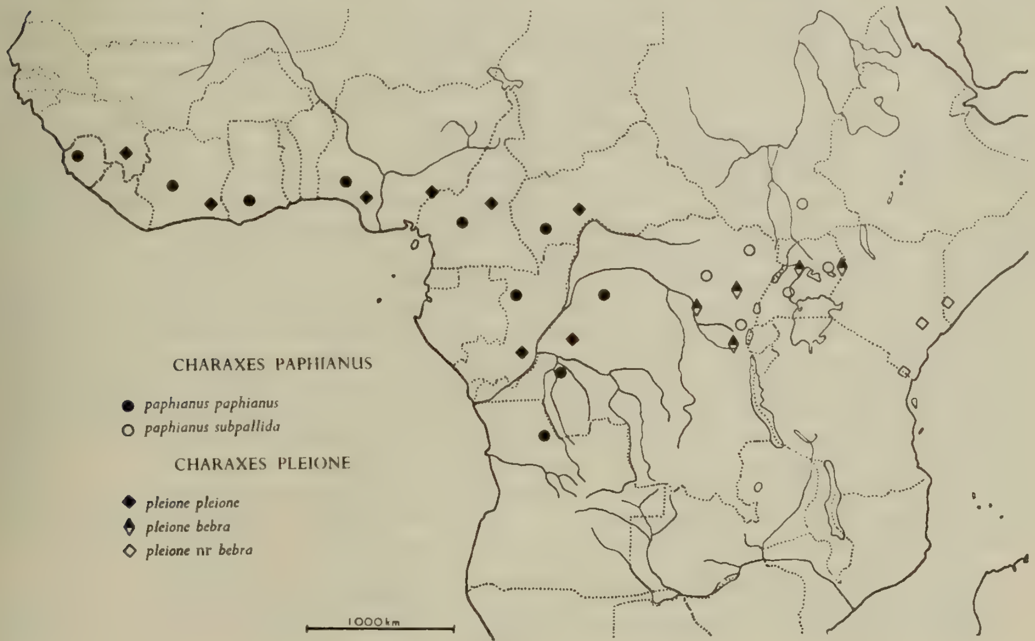
## 2. *CHARAXES PAPHIANUS* WARD AND *CH. PLEIONE* GODART AND THEIR SUBSPECIES

### ***Charaxes paphianus*** Ward

(Pl. 2, figs 21–23; Map 2)

*Charaxes paphianus* Ward, 1871 : 120.
*Philognoma falcata* Butler, 1872 : 101. Gold Coast, Ashanti.
*Palla hamulosa* Weymer, 1892 : 95. Female, Gold Coast.

MALE. Fore wing length 28–30 mm. Fore wing, shape, costa curved, outer margin incised in 4–5 so that the apex is pointed; hind angle almost rectangular. *Upperside*. Fore wing, ground colour tawny orange; pattern very limited, a thin double line at end of cell,


CHARAXES PAPHIANUS
● paphianus paphianus
○ paphianus subpallida
CHARAXES PLEIONE
◆ pleione pleione
◆ pleione bebra
◇ pleione nr bebra
1000 km

MAP 2.

a larger mark crossing sub-bases of 6–5, usually free or slightly joined along the costa to a similar mark in postdiscal line which joins up with the black apex, the black extending down the outer margin to upper edge of 1b; there are sometimes small obscured dark spots in the postdiscal row in 5–4, and more distinct spots in the submarginal line in 4–2. Hind wing ground colour tawny orange, slightly paler on the inner fold, almost immaculate except for three dark marks along the costa, and a faint line in the sub-base; very obscured spots in the submargin, variable in number; margin very slightly dentate, a short robust tail at end of vein 4, 3–4 mm in length, hind angle only slightly produced. *Underside.* Fore wing, ground colour almost uniform umber-brown, slightly paler in the postdiscal zone and on outer margin, crossed by a slightly curved dark line with white on inner edge, extending from just short of the apex to the hind margin at about mid point. Hind wing ground colour as fore wing, almost uniform, but divided by a dark line, continuous with the line on the fore wing, which crosses the wing from mid-costa to just above the anal angle; faint dark marks present in the discal line, edged proximally in whitish; a few obscure dark spots in the submarginal line, in region of the tail, may be present.

Female. Larger than the male, fore wing length 31–34 mm; shape similar to that of male. *Upperside.* Fore wing, ground colour paler, more ochraceous orange, darkening slightly toward the base. Pattern more apparent than in the male but less dark. There are usually two dark spots in the sub-base of the cell, the marks beyond more extended, apex and margin less dark, but submarginal spots more developed. Hind wing ground colour as fore wing, shading to buffish on the inner fold; spots on costa larger, with a slight indication of a faint line through disc; submarginal series of dark ovoid rings enclosing pale ochreous spots, stronger at upper angle; margin brownish, extending to the tail on vein 4, 4–5 mm in length. *Underside.* Fore wing, ground colour much paler than in the male, with faint pattern corresponding to the darker marks of upperside; the conspicuous dark line brownish. Hind wing ground colour as in fore wing, with the dark line crossing the wing and continuous with the line of the fore wing. Border with faint pattern corresponding to that of upperside.

Range. Sierra Leone to Cameroun, Angola and upper Congo.

## ***Charaxes paphianus subpallida*** Joicey & Talbot

(Pl. 2, figs 24–29; Map 2)

*Charaxes paphianus subpallida* Joicey & Talbot, 1925 : 645.

Male. Fore wing length 28–30 mm. Compared with the nominate race, shape much as in that race, apex slightly more pointed. *Upperside.* Fore wing, ground colour slightly paler, dark marks and margin less strong. Hind wing, ground colour as in fore wing, the costal marks very similar to nominate *paphianus.* Tail longer and thinner, 5 mm. *Underside.* Fore wing, ground colour generally paler than in nominate race, but this character is by no means constant; nevertheless, the basal areas of both wings on the proximal side of the dark line paler than the ground on the distal side of the line, which has a series of dark, though rather obscure, spots on the submarginal line. Similar remarks apply to the hind wing. A not uncommon variation amongst the males is noted, in which the ground colour is paler, the costal marks on the fore wing, apex and margin are reduced. The hind wing is almost immaculate, even to the usual costal marks at the apex. The underside is generally paler and overall size is smaller. (Pl. 2, figs 24–29).

Female. Larger than the male, fore wing length 31 mm; shape similar. Ground colour paler, more ochreous. Hind wing buffish on inner fold. Pattern very similar to that of nominate females. *Underside.* Very similar to nominate *paphianus* but slightly paler.

Range. Eastern Congo to Uganda and north-western Kenya, southern Sudan.

Biological note. *Vide* van Someren, 1926 : 346. Food plant *Acacia pennata* et al. (Mimosaceae).

## ***Charaxes pleione*** (Godart)

(Pl. 2, figs 30–35, Map 2)

*Nymphalis pleione* Godart, 1824 : 366.
*Philognoma lichas* Doubleday, 1849 : pl. 49, f. 3.
Form *othello* Suffert, 1904 : 123.
Form *pallida* Lathy, 1925 : 95.

MALE. Fore wing length 28–30 mm; shape, costa slightly curved, outer margin only slightly incurved at vein 4; hind angle projecting and almost rectangular; hind wing margin slightly dentate, single tail at end of vein 4 very short, 2–3 mm in length. *Upperside.* Fore wing, ground colour rich tawny orange in basal third, rest of wing brownish black or black, but the tawny orange and the black area in the region of the cell and beyond join up with the tawny orange spots in the sub-bases of 6–5 and even with the spot in the subapex. The marginal black border usually extends to the hind angle, where it encloses an orange spot, or it may narrow to the hind angle. The small black line at the end of the cell may be free, or it may join up with the apical black. Hind wing ground colour as fore wing, slightly paler on the inner fold. Pattern limited to some black ringlets at the outer end of the costa and upper angle, extending down the outer margin in lessening degree, the rings enclosing ochreous spots; edge of wing blackish. Outer margin dentate, with a short stumpy tail at end of vein 4. Anal angle slightly projecting. *Underside.* Rather variable; fore wing ground colour tawny orange to ochreous orange, with an intricate pattern of dark blackish narrow lines; cell crossed by two fine curved lines in sub-base; an interrupted series of spots beyond and a stronger line toward the mid cell cross into sub-base of 2, ; there is a further dark line at end of cell. Postdiscal zone paler and satiny, flanked on distal side by a dark line commencing at subapex and extending to mid hind margin. This dark line is continuous with the dark line on the hind wing. On its distal border are some dark patches in subapex; mid area and hind margin with a zigzag fine dark line in submarginal line; edge of wing darker brownish, with some whitish satiny marks at apex. Hind wing, ground colour as fore, with the same intricate pattern; a dark line runs along the upper border of the inner fold, joining the dark discal line at an angle above the anal angle; the discal line usually strong, extending from the costa to anal angle, sometimes with a pale streak on proximal side above the anal angle; a shorter dark line from costa forms an angle with the discal line, and in between are some ochreous spots; border beyond the line somewhat darker, carrying a series of pale ochreous angular marks in the postdiscal line, and a similar series in the submarginal zone, both distally accentuated with blackish. Border more rufous, with obscure paler lunules, strongest toward the hind angle, which is rufous outlined in silvery white; extreme edge with whitish internervular marks.

FEMALE. Larger than the male, fore wing length 31–33 mm; shape of fore wing less pointed at the apex, outer margin straight or slightly out-curved. Hind wing as in the male, edge more dentate. *Upperside.* Fore wing, ground colour somewhat variable, uniform pale ochreous orange to ochreous orange at base with paler ochreous beyond. Pattern variable, obscure dark lines through the cell; darker zone at sub-bases of 5–4, crossing the bases of 3–2 and sub-base of 1b, thus accentuating a series of elongate pale ochreous marks in the postdiscal zone, which extend from the costa to hind margin, distally edged with darker brownish, most distinct at hind angle in 2–1b; border of wing darker brownish from apex to hind angle. Hind wing ground colour as fore, almost uniform ochreous orange or paler in the postdiscal zone. The dark line of underside may show through. Sub-margin with a series of triangular marks, enclosing paler ochreous, these may be strongly or weakly indicated. Edge of wing with dark line slightly rufescent on edge; tail dark, short at end of vein 4, 3 mm in length. *Underside.* Equally variable in ground colour, from pale ochreous to buffish; pattern variable in strength from weak to strong, the constant feature is the dark, almost straight line which crosses the fore wing from the subapex to the hind margin and continues through the hind wing from mid costa to hind angle. Fore wing with fine dark lines through the cell, that in the subapex strongest and extending to sub-base of 1b. On the proximal side of the dark line is a series of curved fine lines extending through sub-bases of 7–5 and 2–1b, sometimes with a mid dark streak. Distal to the dark line is a series of pointed marks enclosing pale ochreous, interrupted by dark patches in 1b and 3. Outer border with faintly indicated darker lunules; edge of wing more rufous. Hind wing with the strong dark cross-line well marked, joined at an angle by a dark line from costa to end of cell, and a faintly indicated line at upper border of inner fold. Base of wing with faintly indicated interrupted lines and on the distal border of the dark line, a series of double-pointed marks enclosing paler ochreous in the postdiscal zone; these are followed by more triangular pale spots outlined distally in brownish black and strongest at hind border; edge slightly rufescent.

RANGE. From Sierra Leone to Angola and Upper Congo, merging with the next race in the eastern Upper Congo.

## ***Charaxes pleione bebra*** Rothschild

(Pls 2 & 3, figs 36–42; Map 2)

*Charaxes lichas bebra* Rothschild, 1900 : 507.

MALE. Fore wing length 25–28 mm; shape similar to nominate race, but fore wing hind angle more produced and pointed. *Upperside.* Fore wing, ground colour less dark, brighter tawny orange; black areas at apex and outer border much reduced, so that the orange intrudes over the cell and into the bases of 6–3, particularly into 5–4, so that the black is limited to the apex and the outer border, but with an intrusion in cellule 3, but this black in 3 may be almost isolated, though in contact with a series of dark lunules in the submargin. The curved line towards the end of the cell is usually thinly indicated. Hind wing ground colour as fore wing, paler on the inner fold; pattern limited to a few dark ocelli with paler centres at upper angle; admargin of wing lined in black with two silvery lines at the anal angle. *Underside.* Variable, conforming in the main to that of the nominate race.

FEMALE. Larger than the male, fore wing length 25–30 mm; shape less incised on the outer border than the males, but the hind angle well produced. The margin of the hind wing more dentate, the tail robust but short. The whole insect is more fragile looking than the male. *Upperside.* As in the nominate race, the ground colour varies from a pale ochreous orange, almost uniform, to a richer ochreous orange, and the pattern from lightly marked to moderately strong, the most pronounced feature being the submarginal rings enclosing a paler ground, especially noticable on the hind wing. *Underside.* Essentially similar to that of the nominate race, but ground colour paler buffish to ochreous, more constant; the pattern of dark lines relatively stronger, especially the cross bars on fore and hind wings, which show up strongly; the dark patches distal to the dark line, on fore and hind wings, strong; the lines on the inner fold more marked.

This race shows a greater degree of constancy, above and below, than the nominate.

RANGE. Eastern Upper Congo to Uganda as far east as Mt Elgon. It appears again in almost identical form in the coastal districts of Kenya, on the Shimba Hills and on the lower slopes of the Usambara Range in Tanzania, where the representatives of both sexes are slightly larger, fore wing length 30–32 mm, with a richer rufescent orange underside, but pattern similar. The hind wing border slightly more dentate.

BIOLOGICAL NOTE. *Vide* van Someren, 1929. Food plant *Acacia pennata* et al. (Mimosaceae).

SYSTEMATIC LIST

### *Charaxes paphianus* Ward

*Charaxes paphianus paphianus* Ward, 1871. Type locality: Cameroun.
Range: Sierra Leone to Cameroun, Central African Republic, Republic of Congo, western Congo to Angola.

*paphianus subpallida* Joicey & Talbot, 1925. Type locality: Congo.
Range: Eastern Congo to Uganda, north-western Kenya and southern Sudan.

### *Charaxes pleione* (Godart)

*Charaxes pleione pleione* (Godart), 1824. Type locality: Gold Coast.
Range: Sierra Leone to Angola and Upper Congo, Central African Republic, Republic of Congo and Congo.

*pleione bebra* Rothschild, 1900. Type locality: Beni, Eastern Congo.
Range: Eastern Upper Congo to Uganda as far as Elgon. Appearing again in slightly different form in the coastal district of Kenya on the Shimba Hills and on the lower slopes of the Usambara Range, Tanzania.

## 3. *CHARAXES ACRAEOIDES* DRUCE, *CH. FOURNIERAE* LE MOULT, *CH. NOBILIS* DRUCE AND *CH. SUPERBUS* SCHULTZE

### *Charaxes acraeoides* Druce

(Pl. 3, fig. 43; Map 3)

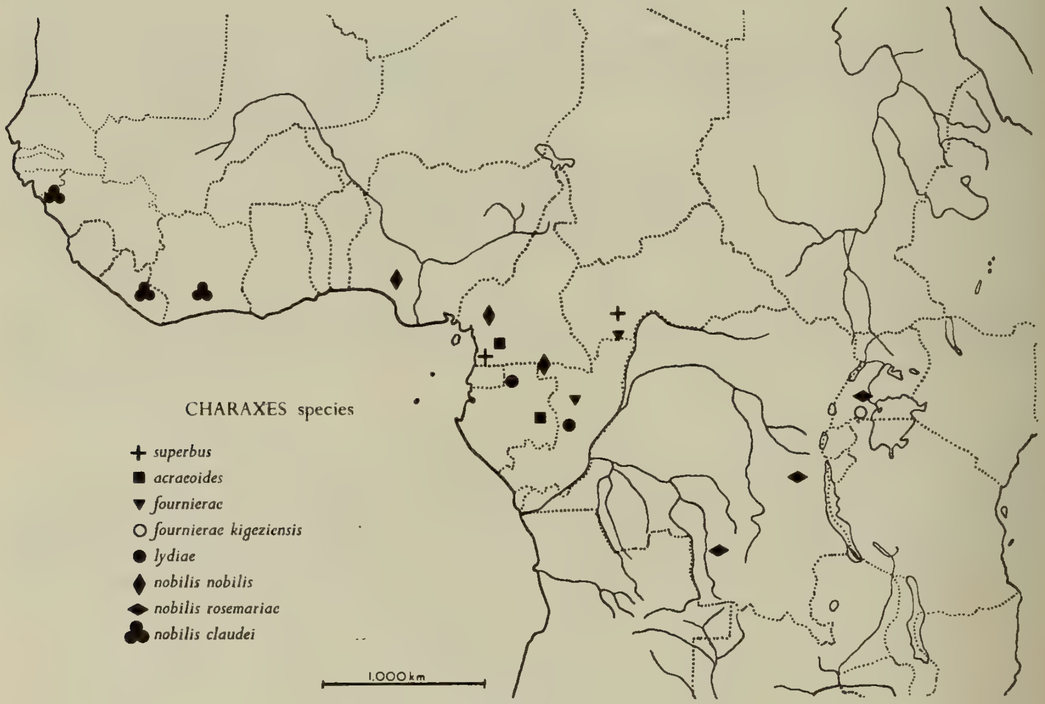
*Charaxes acraeoides* Druce, 1908 : 449.

A remarkable feature of this insect is the size and width of the thorax, width 10 mm, length 16 mm. It is known only from the male sex, of which quite a number have been captured.

MALE. Fore wing length 50 mm; shape, apex prolonged but not pointed, the outer margin slightly concave at 3–4, but the hind angle does not project; the length of the wing at vein 1 is 35 mm. *Upperside.* Fore wing, ground colour black, the pattern in dull red. There is an obscure reddish triangle at mid cell, a larger red triangle at base of 2, and streak-like reddish marks in base of 1b in the form of a <: the discal marks are: a long streak in 1a, a large quadrate mark in 1b, the inner end of which is pointed and projecting within the basal V. the mark in 2 is smaller, somewhat triangular with distal end pointed; there are usually two obscure reddish spots distad to the large mark in 1b, in the submarginal line; the mid areas of 3–5 carry an ochreous bar, the two upper spots with straight inner ends, but pointed distally, that in 5 small and triangular, point inwards. Hind wing mainly brick-red, shading to blackish at the base but the inner fold is ochreous, black margined above the anal angle; the border of the wing is black, with five white dots. The disc of the wing has an elongate ovoid black spot at the end of the cell. In addition some of the strong black marks of underside show through faintly. The margin of the wing is bluntly dentate with a slight indication of a 'tail' at end of vein 4, but the anal angle projects roundly and has a minute white dot in the centre. *Underside.* Fore wing cell area olive-ochreous, slightly more greenish in upper discal area, the remainder of the discal zone is dull reddish orange, fading to ochreous on the hind margin in 1a. The cell has three rounded spots at the base followed by an S mark beyond and an irregular quadrate bar at the end of the cell. The bases of 1b and 2 have black marks, while the inner part of the discal area has a strong angled mark in 1b and a curved mark in sub-base of 2. At the upper portion of the discal zone is a black bar made up of three rounded spots in 6–4, followed by longer marks in 3–2. In the submarginal line at the tornus are dumb-bell-like marks in 1b, with black streaks along the ends of veins 1, 2, & 3; the veins and interspaces above, up to the costa, strongly lined in black. The pale ochreous bar of upperside is here represented and similarly coloured. Hind wing, ground colour orange-brick-red, paler in the disc and above the anal angle which is ochreous. Strong black spots are present: an irregular black mark at extreme base with thin black lines directed toward the anal angle and on inner edge of fold; three black spots at base of cell and a larger one at its end; two rounded black spots at sub-base of 7, and two black spots basal in 6 with rounded spots below in sub-bases of 4–3. Border of wing with black rays at end of veins and black interspaces each with a white spot; the admargin has interrupted ochreous triangles, that at anal angle with twin lilac spots.

Female. This still appears to be unknown.

Range. Cameroun and the adjacent area of Republic of Congo (French Eq. Africa—Moyen Congo).



Map 3.

## ***Charaxes fournierae*** Le Moult

(Pl. 3, figs 44–45, Map 3)

*Charaxes fournierae* Le Moult, 1930 : 171, ♂.
*Charaxes fournierae* Le Moult; Le Moult, 1933 : 17, ♀.

MALE Fore wing length 40 mm; fore wing slightly curved at costa, more strongly at base, apex falcate, but tip rounded, outer margin concave at 3–5, hind angle projecting but rounded. Hind wing rounded, but hind angle projecting, margin of wing slightly dentate, most marked at 2–4. *Upperside.* Fore wing from base to border deep black, with a large tawny orange patch extending from the sub-bases of 1a–2 extending distad to within 7 mm of the border in 1a, with an irregular curve in 1a–1b and the lower portion of 2. The subapex with a large more rounded tawny orange patch filling the mid areas of 3–5, less so in 6, the outer margin irregular. Hind wing mostly orange-tawny, paler on the inner fold, meeting the black outer border in a curve which is immaculate. There is a dark rounded spot in the subcosta, toward the base. *Underside.* Fore wing, ground colour tawny orange tinged with greenish in cell and along costa, where veins are black and clearly defined. Numerous black spots in discal and submarginal areas. One filling base of cell, two large, rather 'S' shaped ones crossing cell and equidistant from the base and each other and the one at cell-end, which also covers the bases of spaces 4, 5 and 6. A curved series of contiguous spots in the sub-bases of 6, 5, 4 and 3, the latter extending along vein 3 to near the black marginal spots. There is a smaller spot at base of space 3 adjacent to a large spot or bar crossing space 2, In space 2, immediately below the basal spot of space 3 is a large rather rounded triangular spot. There are two conjoined spots situated basad in the upper half of 1b. Two large rather irregular shaped spots in the post-discal area of 1b, the lower conjoined with the blackened tornus. Large twin black spots in the ochraceous olive submarginal and marginal areas of 1b with a faint indication of some above these in the blackened margin, which broadens at the apex and extends basad as interneural rays into the orange-tawny subapical area. Hind wing, ground colour tawny orange with a faint rosy tinge basad. Two small black spots in mid area of space 8, the outer small and half the size of the inner, which is only slightly smaller than the one situated basad in space 7, and a small spot in space 5. There is a double row of spots in the submarginal areas on a greenish tawny ground in spaces 7–2. Twin blue-centred marginal spots are present in the prominent tornal lobe. The greenish black of outer margin extends along the inner margin as far as vein 1a.

FEMALE. Larger than the male, length of fore wing 60 mm; shape less falcate; hind angle not produced, and angle almost a right-angle. Hind wing, margin rounded, edge serrate, with a suggestion of 'tails' at end of veins 2 and 4. *Upperside.* Fore wing ground colour black, with a large tawny orange patch occupying nearly the whole of basal two thirds of 1a–2, the outer border rounded but rather irregular, 11 mm from the hind angle in 1a and 13 mm in 2; another more rounded tawny orange patch is present toward the subapex, occupying the upper mid area of 3, widest at 4–5 then contracting in 6, the outer edge of the patch irregular. Hind wing with a large tawny orange patch, extending to, but paler on the inner fold which is rufous at its base, not quite reaching the base of the wing, where it is blackish. There is a dark dyslegnic spot at the subcosta; the outer border of the tawny orange area, which extends along the veins into the black border, is not sharply defined from it, as at the line of junction the patch is 'frayed'; border widest at 6, tapering to the hind angle and extending slightly up the inner fold; serrations on the edge black with slight white fringe between. The anal angle with a greenish line on admargin, and more proximad, three greenish blue spots arranged in a triangle. *Underside.* Fore wing, tawny orange areas more or less as above, but that toward the hind margin of the fore wing more irregular on its distal side, while the subapical patch is larger than above, its inner edge sharply defined, but the outer with rays along the veins, the upper edge reaches the subcosta. There are two large black spots in the sub-base of 1b and a larger one in sub-base of 2. The cell, crossed by alternate heavy black bars, is tawny ochreous in between, base of cell black; two heavy bars wavy in mid area and a straight bar at end; the black bar beyond in sub-bases of 4–6 conjoined with the heavy black bar which separates the upper tawny patch from the lower, and this bar is continued into 1b and 1a; the submargin carries a series of blackish spots extending from the subcosta to 3, with rays which extend to outer margin and separated by tawny rays, the black spots in the submarginal line from 3 to hind angle are in the form of ocelli, double in 1b. Hind wing mostly tawny orange, carrying four black spots in sub-cases 8, 7 and 5, that in 5 round and large; a small spot in 4, the outer edge of the tawny orange area defined by a series of contiguous black spots extending from the costa at upper angle to above the hind angle; this is followed by a zone of ochreous olive, in which there are rounded black spots of increasing size from the upper angle to the anal angle, where the spot is double, with two bluish white spots; edge of wing black with black along the veins; fringe between serrations pale whitish.

Palps rufous, with rufous spots in the mid line of the thorax and small spots on its side; abdomen with five rufous spots in central line.

RANGE. Republic of Congo (French Congo), and Central African Republic.

## ***Charaxes fournierae kigeziensis*** Howarth

### (Pls 3 & 4, figs 46 & 47; Map 3)

*Charaxes fournierae kigeziensis* Howarth, 1969 : 152.

MALE. Fore wing length 50 mm; shape, costa slightly more curved than in the nominate race, the outer margin strongly incised, the apex falcate but tip rounded; hind angle projecting but rounded. Hind wing rounded to 3, the anal angle projecting strongly but rounded; the margin of the wing dentate, with the largest projection on vein 4. *Upperside.* Fore wing, ground colour black, pattern very similar to that of nominate male, but tawny orange patches more restricted, the patch on the hind margin filling the mid areas of 1a, 1b and slightly into 2; the subapical patch smaller than in nominate race, more sharply cut off on its upper costal end, the upper edge straighter, so also the distal side, this patch thus fills in the mid area of 3, the sub-bases of 4 and 5 and slightly into 6. Hind wing, tawny orange patch large, shading to blackish on the inner fold, which has an elongate pale mark in its centre. The orange patch is more restricted than in the nominate race; it has a dark spot in the subcosta, which may be obscured; the black border is wider than in nominate *fournierae*, clearcut on its inner edge, of almost even width from the upper angle to 4, where it contracts to give way to the projecting anal angle; this border is immaculate except for two blue spots at the anal angle. *Underside.* Fore wing ground colour black with a slight greenish tinge along the costa; tawny ochreous patches more extended than above, that on the hind margin extended more toward the base and distally, but reduced at upper border by two curved marks in its upper part of 1b, the outer one larger. The cell is crossed by a greenish ochre bar with a triangular extension into the base of 1c; there is also a dot in the sub-base and a pale angular line at vein 2 which connects up with the submarginal series of pale marks along this vein. The subapical patch is paler and larger than upperside and more extended toward the apex and costa, where it is shaded with greenish ochre; the submargin has a series of greenish ochre spots and rays, extending from the costa to distal edge of the patch, the marks in 1b–2 larger and more defined, with angular extensions toward the margin. The hind wing is mainly tawny ochreous, more orange toward the base; there are two large rounded black spots in 8 at subcosta, followed by a larger spot in 7 and a smaller rounded spot in sub-base 5 and a minute dot in space below. The outer border of the tawny patch shades to greenish ochre, and this zone carries a series of discrete ovoid black spots, which become conjoined and forming a line above the anal angle; the border carries a series of larger black spots, most of which connect up with the marginal black, the veins between them also black. The anal angle has two blue spots and a small dot in space above.

FEMALE. The palps and spots on the thorax are tawny orange, the abdomen black, with two small tawny spots in the mid line. Larger than the male, fore wing length 64 mm; shape less falcate; hind wing rounded, the anal angle not projecting, the margin is bluntly dentate in lower half. *Upperside*. Fore wing pattern and colour as in the male, but bolder; the patch on the hind margin larger and more orange, extended basad and on its outer border toward the hind angle; the area within 1b with two blackish spots, and there is also a tawny streak in the lower part of the cell. The subapical patch is larger than that of the male and more tawny orange, extending from 3–7, the outer border zigzag, the inner more evenly curved; there is also an extension in the form of a triangular mark in the submargin of 2. Hind wing, mostly tawny orange, paler toward the costa and the inner fold which is buffish, with longitudinal dark lines where it joins the discal patch, the lower part brownish black. The black border is of more or less even width, though tapering slightly at the upper angle, 7 mm wide, invaded by tawny rays along either side of the veins from the patch, these being especially marked at the upper angle. The border is black and immaculate, except for these rays and the blue spots on admargin from 4 to the anal angle, where the spots are double with an indication of a greenish circle around them. *Underside*. Fore wing, costa greenish blue; tawny orange areas greatly extended but paler in colour compared with upperside, both in the disc and the subapex, the extensions into the cell paler, with a greenish ochre tinge. The black marks are strong, those in the cell are: one at base, an S mark at about mid point and a bar at its end, black spots also present in the sub-base of 2 and a double spot at upper part of base in 1b. The discal tawny area is separated from the subapical by a series of conjoined black marks forming a bar across the wing, from the subcosta to the margin in 2, represented in 1b by two bold black spots with a black curved line distally, which extends to the hind margin. The subapex has three black marks, the upper two elongate; the submargin carries a series of black marks, elongate from subcosta to 4, then more triangular but rounded and double in 1b, these marks separated by the dark ends of the veins. Hind wing ground colour as fore wing, the black spots bold, two black spots in sub-base of 8, larger conjoined spots in sub-base of 7 and a rounded spot in 5. The tawny ochre colour of the wing shades into the more greenish ochre border, where there is a series of discrete black rounded and ovoid spots which extend from the subcosta to the hind angle, where the black marking becomes a line.

On the submargin, within the greenish ochre border, is a series of larger black ovoid spots, that at anal angle with two blue spots. The veins between are black, extending inward from the narrow black edge, with the black extending up the inner fold.

RANGE. Uganda, in the south-west in the Kigezi district, in the Ishasha Gorge, Kayonza, where two males and three females have been taken.

## ***Charaxes nobilis*** Druce

### ***Charaxes nobilis nobilis*** Druce

(Pls 4, 5, figs 48–52, 56, Map 3)

*Charaxes nobilis* Druce, 1873 : 13.
*Charaxes agabo* Distant, 1879 : 708.
*Charaxes homerus* Staudinger, 1891 : 132.

MALE. The jet-black thorax and upper abdominal segments are in strong contrast to the creamy white of the abdomen. Fore wing length 46–49 mm. Shape, apex tapering due to the strong inward curve of the outer margin in 3–4. *Upperside*. Fore wing, ground colour deep black, with olive sheen at base; a broad creamy band in the discal line extends from the hind margin to 3, the marginal mark in 1a elongate, that in 1b quadrate, 9 mm, the mark above as long but smaller, with proximal end rounded, the distal end angled, the mark in 3 smaller, and ovoid, the two upper spots separated by black and free; beyond in 5 is an oval creamy spot and in the costal region of subapex a smaller, less distinct spot. Margin of wing with small white dots from hind angle to just short of the apex. Hind wing, basal area blackish, shading to smoky greyish, thus the large creamy area is not sharply defined proximally but is clear-cut distally, where it meets the broad black border which extends from the upper angle to the hind angle and slightly up the edge of the inner fold. Submargin with large bluish grey spots, double at the anal angle and represented on the inner fold by a triangular white spot; admargin with thin interrupted triangles, most evident in region of tails, that at anal angle tawny orange; edge of wing bluntly dentate, the tails sharply pointed, 5 & 4 mm in length. There is a black spot at sub-base of costa on the distal side of a shadow bar, where the strong black line of underside shows through. *Underside.* Fore wings, ground colour black, but pattern very bold; a white line at base of costa connecting with a bold white line on side of thorax; cell with two minute white dots in base, followed by a vertical silvery white line with another transverse line at mid-cell, and another larger, more quadrate spot at upper end of cell; on the lower vein of the cell is a white interrupted line in bases of 1b–2. Beyond the cell at bases of 5 and 6 is a large, somewhat triangular, silvery white mark, while beyond is a transverse silvery white bar of three spots, represented by a streak at costa and two larger marks separated only by the black veins. In the subapex are three somewhat quadrate silvery white marks arranged in a curve, separated only by black veins followed in the submargin by two smaller more rounded spots in 5–4; below in 2 & 1b are larger, more quadrate, conspicuous tawny orange marks, and a small tawny spot in 1a. The admargin carries a row of bluish grey lunules from hind angle to 3; edge of wing black with small white dots. The disc of the wing is occupied by a wide creamy band corresponding to that on the upperside, though somewhat wider. Hind wing, ground colour silvery white, traversed by two bold black curved lines; one passing through the sub-basal area curves round the edge of the inner fold and joins the submarginal band, the other runs through the disc from the costa and end of cell to above the anal angle; these two bold lines are joined by an inverted Y, the upper arm heavy, the lower thinner, the stalk and upper arm running along vein 2; in the submargin there is a bold black band partially separated into two by interrupted ochreous to orange lines, strongly orange at the anal angle, which has two lilac, black-ringed spots; on the distal side of this band is a series of bold white spots, those at the upper angle smaller, running from the upper angle to vein 2 and represented on the inner fold by a white triangle; the admargin has a series of interrupted white angular marks; edge of wing and tails black.

FEMALE. Fore wing length 55 mm. Shape less falcate than the male, outer border less incised; hind wing more rounded. *Upperside.* Fore wing, general pattern and colour as in the male but ground colour less intense black, the white patch on the fore wing in the hind area wider; the two subapical white spots larger, with an indistinct whitish mark toward the apex. There is also a slight indication of spots in the submarginal line corresponding to the spots of underside. A series of small white marginal spots, one to each interspace, except for space 1, where there are two. The hind wing basal white patch is more extended basad than in male and not sharply defined from black base; the inner fold more dusted over with brownish scales; the hind wing border is not so intense black, and the larger bluish spots more tinged with mauve; the admarginal row of lunules more distinct. Tails more robust in proportion to general larger size. The abdomen is black. *Underside.* Fore wing, generally similar to that of the male, but the white markings are more extensive, but not so silvery white. Hind wing pattern as in the male but ground colour less silvery white; the white marks in the black border more developed, especially the series of white marks on the admargin and those in the postdiscal line. Underside of abdomen black with interrupted white segmental rings.

This description is made from a female specimen taken at Burumbi, Cameroun, (*Preuss*), kindly loaned by Dr Hannemann, Berlin Museum. This specimen is marked as 'type', presumably of this sex, not of the species.

RANGE. West Africa, from Calabar in southern Nigeria to Cameroun and Congo Republic (French Equatorial Africa).

## ***Charaxes nobilis rosemariae*** Rousseau-Decelle

(Pls 4 & 5, figs 53–55; Map 3)

*Charaxes nobilis rosemariae* Rousseau-Decelle, 1934 : 233.

MALE. *Upperside.* Differs from the nominate race mainly by the greater expanse of the creamy patch in the fore wing and increased creamy area of the hind wing. Fore wing ground colour jet-black with slight olive sheen at base of wing. Discal creamy area broad, 16 mm at the hind margin and 1b and lower portion of mark in 2, the mark in 3, 10 mm at lower edge; inner ends of marks rounded, outer dentate in 1b, and sloping in 2 & 3; a pear-shaped bold creamy spot present in 5, and an obscure whitish mark at subapex. Hind wing, basal black area more restricted; the creamy patch thus wider, with a shadowy bar in sub-base representing the dark line of underside. Border black with slight greeny grey scaling proximally, the black extending up the edge of the inner fold; submargin with bold bluish grey spots, represented above the anal angle by a white spot; admargin with interrupted angular marks of bluish grey; anal angle olive, with lilac spots. It may be noted here that the upperside of the abdomen is ochreous, with four black cross lines, not creamy white as in the nominate race. *Underside.* Fore wing, ground colour black; silvery white lines and spots in and below the cell much as in the nominate race, but subcostal and subapical marks bolder; the upper three submarginal spots bold, those in 4 & 3 smaller and more linear, the tawny orange spots bold; admarginal bluish grey spots only present at 1a–1b; white dots on edge distinct. The large discal patch creamy, arranged as above. Hind wing ground colour silvery white; black lines in sub-base and across disc as in the nominate race but bolder as also the black border and submarginal silvery white spots.

FEMALE. *Upperside.* Fore wing creamy white discal band is more extended distally, thus reducing the width of the black border, on the proximal side, the creamy area extends more basad and is more rounded. The white marks in 5–6 bolder, as also is the subapical white spot. On the hind wing, the creamy white discal area is more extended basally and distally, so that the black border is reduced in width; the blue submarginal spots are well developed, as also are the admarginal marks. *Underside.* Though conforming to that of other races, it has extended white areas on both fore and hind wings; on the fore wing there is some linking of the large white marks in 7–5 with the upper mark on the discal patch, in area 4. On the hind wing the wider white patch encroaches more onto the black border; the submarginal white marks well developed as are also the admarginal triangular marks. Upper tail strong and robust, rounded at end, lower tail shorter, and more pointed, 10 mm and 5 mm long.

RANGE. Congo (Kinshasa) in the Katanga district, Kafakumba; also recorded from western Uganda, in the Kalinzu Forest.

I am indebted to Major Grahame for photographs of a male and female of this race. The male agrees in all respects with an example taken in western Uganda (Pl. 5, fig. 54.) It will be noted that the creamy white bar in the fore wing is considerably wider than in any other race; that of the hind wing extending basad and distally, so that the black border is narrower.

## ***Charaxes nobilis claudei*** Le Moult

(Pl. 5, figs 57 & 58)

*Charaxes nobilis claudei* Le Moult, 1933 : 17.

MALE. Fore wing length 45 mm; shape similar to nominate race. *Upperside.* Fore wing, colour and pattern also very similar, but differing appreciably by a reduction in the size of the white spots, especially those on the hind margin and 1b, and 6 & 7 mm wide, the spot in 5 large and ovoid, those in the subapex, especially that in 7, moderately large and distinct. The hind wing band also reduced in width and not extending basad, especially at the costa, where it is only 13 mm; the submarginal row of blue spots much reduced in size; the white spot above the anal angle very distinct; the marginal border triangular blue spots distinct. Tails thinner, 6 mm in length. *Underside.* Coloration and pattern very similar to that of nominate race, but discal white bands much reduced in width, exhibiting a similar reduction to that noted on upper side.

FEMALE. *Upperside.* Fore wing, the reduction in the width of the bar is even more marked, the reduction being on both borders, but especially distally, width at 1a–1b, 16–12 mm. The white spot in 5 large and ovoid, the one above, small. The hind wing exhibits a similar marked reduction in the width of the discal band, both toward the base and distally, so that the black border is wide. The submarginal blue spots are limited to a few toward the hind angle, while admarginal interrupted spots are distinct and olive at the anal angle. Tails, upper 10 mm, lower more slender and pointed, 6 mm. *Underside.* Fore wing, though conforming to the usual pattern of the species, the discal white band is reduced in width as above; the marginal white spots are well developed, and at the hind angle there is a series of white admarginal spots in 1a and 1b. On the hind wing, the pattern conforms to that of the species as a whole, with reduced white areas; the submarginal white spots well developed, those on the admargin also strong, but at the anal angle there is a distinct double-eyed ocellus.

I am indebted to Monsieur Jacques Plantrou, Paris, for photographs of this subspecies.

RANGE. At present known only from the western countries of 'West Africa': Guinea, to Ivory Coast.

## ***Charaxes superbus*** Schultze

(Pl. 5, figs 59 & 60; Map 3)

*Charaxes superbus* Schultze, 1908 : 172.

This species is very similar to *Charaxes nobilis* Druce, but can be readily distinguished by the ochreous distal edge to the hind wing discal creamy white patch, which is even more evident on the underside. There are other differences, which will be mentioned in the descriptions.

MALE. Fore wing length 46–50 mm; costa slightly curved, apex rounded, but outer border strongly incised at 2–3, hind angle projecting at 1a–1b, forming almost a right angle to the hind border. *Upperside.* Fore wing ground colour black; margin with small creamy white spots, double in 1b. Disc of wing with a series of creamy white elongate marks commencing at about mid-point on the hind margin, extending through 1b, where the lower part of the mark is extended, proximally and distally, the mark in 2 shorter but also with extension in lower half, thus giving the band an irregular edge; the band is represented in 3 by a crescentic or ovoid smaller spot, and in mid-point of 5 and 6 by smaller spots; there is also a small white subcostal spot in the subapex. There is some slight difference in this band in specimens from Cameroun and from Ouesso, Republic of Congo. (Moyen Congo.) Hind wing, basal triangle black, shading to white on the upper part of the inner fold, remainder of fold black, with a white spot above the anal angle. Disc of wing with a broad creamy white patch, commencing at the upper margin and extending to just short of the inner fold, its outer border shaded with ochreous, especially on its lower half. Border of wing black, carrying a series of bluish white spots in the submarginal line, and a series of double white marks on the admargin, the marks at anal angle bluish to lilac. Edge of wing bluntly dentate, but with strong though shortish tails at ends of veins 4 and a less strong tail at 2 conjoined to the anal angle, which is strongly produced. Distal half of abdomen white. *Underside*, boldly marked in white on a black ground. Fore wing, base of costa white; cell with two small linear marks at base and a large triangular or quadrate mark at end; small irregular white marks at bases of 1b, 2 & 3; discal white patch corresponding to that of upperside here slightly broader, but with less jagged edges, the mark in 1b with incised inner end to accommodate the white mark in sub-base; the crescentic spot in 4 is continued up toward the costa by elongate marks, forming a bar; beyond this is a bar of contiguous white spots in 5–7. The submargin carries a series of almost quadrate spots, the five upper ones white in colour, the others more separated and buffish ochreous; the admargin has a series of white spots, double in 1b. Hind wing, basal area black with a narrow white line at base, followed by a broader angled white bar extending from the costa, through the sub-base of the cell, then tapering toward the inner fold. This is followed by a long triangular mark in white, its base towards the anal angle, and flanked by a longer mark tapering at both ends in the inner fold, which has a further narrow white line along its inner edge. The disc of the wing has a large white patch, triangular in shape, base toward the costa, tapering towards the anal angle and shaded on its distal side by ochre-yellow. The submarginal row of spots is complete from upper angle, where the spot is small, to the hind angle where the mark is bluish. The admargin carries double, triangular white spots; edge of wing black.

FEMALE. Larger than the male, fore wing length 60 mm. *Upperside*. Fore wing, ground colour black, not so intense as the male. Creamy white pattern in disc of wing, similar to that of male, but enlarged; the spots in the subapex also larger; the submargin has a series of obscured whitish spots, the subcostal one white and distinct; the white marginal spots are larger than in the male and so more distinct. The hind wing basal area is black, which extends into the inner fold, which has three whitish elongate streaks and a large white spot above the anal angle. The discal creamy white band as in the male, but broader, the upper costal end almost parallel-sided, the lower end angled to above the anal angle, strongly shaded on its outer side by ochreous. The submarginal spots are bluish white, terminating in the double spot at the anal angle. The marginal double triangular spots are white, those at base of tails extending up the tails. Tails longer and more robust than those of the male, upper 10 mm, lower 5 mm; anal angle with bluish white edge. Upper side of abdomen buffish. *Underside*. Ground colour black. Pattern as in the male, but bolder. The submarginal row of spots bold, the five upper white, those toward the hind angle ochreous. Hind wing, pattern as in the male, but bolder, the linear marks on the inner fold well marked. The discal white patch as in the male but outer border strongly edged in ochre-yellow. The submarginal and marginal spots bolder. Underside of abdomen brownish with buffish cross lines.

I am indebted to Monsieur Jaques Plantrou for photographs of typical specimens, including the neallotype female.

RANGE. Cameroun, with a slight extension into adjoining Republic of Congo, at Ouesso.

## SYSTEMATIC LIST

### ***Charaxes acraeoides*** Druce

*Charaxes acraeoides* Druce, 1908. Type locality: Cameroun.
Range: Cameroun and adjacent area of Republic of Congo (French Equatorial Africa—Moyen Congo).

### ***Charaxes fournierae*** Le Moult

*Charaxes fournierae* Le Moult, 1930. Type locality: French Congo (Republic of Congo).
Range: Republic of Congo and Central African Republic.

*fournierae kigeziensis* Howarth, 1969. Type locality: Kayonza, Kigezi, Uganda.

Range: South-western Uganda, in the Ishasha Gorge, Kayonza of the Kigezi district.

### ***Charaxes nobilis*** Druce

*Charaxes nobilis* Druce, 1873. Type locality: Old Calabar, Nigeria.

Range: West Africa, from southern Nigeria to Cameroun, Congo Republic (French Equatorial Africa).

*nobilis rosemariae* Rousseau-Decelle, 1934. Type locality: Kafakumba, Congo (Kinshasa).

Range: Congo (Kinshasa), Katanga district, Kafakumba. Also recorded from western Uganda in the Kalinzu Forest.

*nobilis claudei* Le Moult, 1933. Type locality: Guinea.

Range: Only known from western countries of West Africa: Guinea to Ivory Coast.

### ***Charaxes superbus*** Schultze

*Charaxes superbus* Schultze, 1908. Type locality: North-western Cameroun, Bipindi.

Range: Cameroun and adjacent area of Republic of Congo at Ouesso.

## 4. The ***CHARAXES EUPALE*** Complex

The last comprehensive review of the '*eupale*-group' was that by Joicey & Talbot in 1921. They considered that members of this 'complex' could be divided into three species, two with sub-species, on the basis that these 'species' overlapped and were found together, and that the genitalia differed somewhat. A study of a very large number of specimens from throughout their range, supports their view in the main.

The general grouping as given by Bryk, 1939 : 462–465, conforms more or less with that of Joicey & Talbot, and is here used as a basis for discussion. One new species has been added since 1939.

### ***Charaxes eupale*** (Drury) and its subspecies

### ***Charaxes eupale eupale*** (Drury)

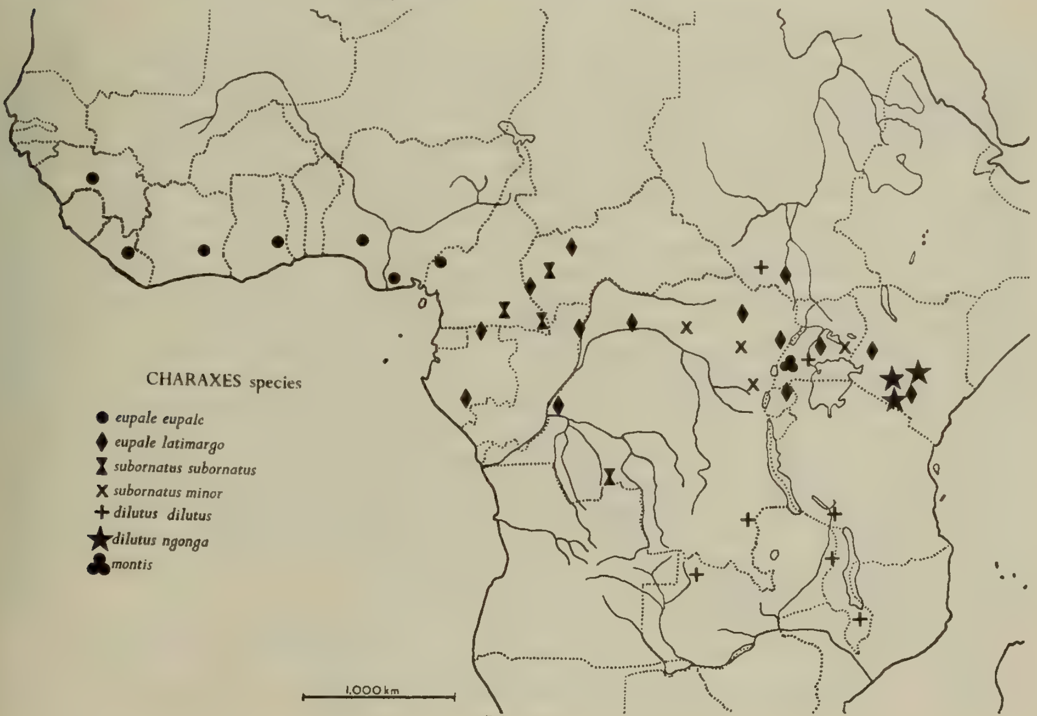
(Pl. 6, figs 61–64, Map 4)

*Papilio Plebejus Urbanus eupale* Drury, 1782 : 7.
*Papilio Nymphalis amasia* Fabricius, 1795 : 136.
*Charaxes eupale* (Drury); Doubleday, 1844 : 111.
For full references, *vide* Bryk, 1939.

Male. Fore wing length 30–35 mm. Shape, apex rather pointed but not falcate. *Upperside.* Fore wing basal half of wing pale satiny greenish white, distal half dull matt green, the line of division clear-cut, starting just beyond the end of the cell, at which point there is a black spot, at right angles to the costa, crossing to well within the hind angle, the inner edge of the green somewhat sinuate and often accentuated by some brownish scaling, most evident at the tornus. There is often a black spot in postdiscal line on veins 6 and 7. Hind wing, almost uniform satiny greenish white, with a slight shading to brownish on the edge of the inner fold and the margin; submargin with a row of brownish black spots, usually triangular in shape, with off-centre black dot, that at anal angle with white centre. *Underside.* Fore wing, dull matt greenish shading to almost whitish in 1a and the greater part of 1b; cell with obscured silvery white lines in sub-base, with a stronger whitish bar at mid point often with brownish centre and a dark spot at upper part of cell end. The disc of the wing with two brownish marks outlined in white in upper part of 1b, 2 & 3, often indistinct and frequently rubbed off; submargin with rather obscure whitish spots, rather variable, the two in subapex with black dots distally. Hind wing, ground colour as fore wing, the cell with a few white scales forming a very broken bar and often obscure; a rather ill-defined series of white marks, larger and with some brownish scaling in mid area, extends from the costa to just above the anal angle; submargin with series of small black dots with white surround, largest in 3, and double at anal angle.

Female. Fore wing length 34–35 mm, thus larger than the male, the greater size enhanced by the less pointed tip and straighter outer margin. *Upperside.* Fore wing, general colour duller than the male, the line of division between the basal greenish-white and the darker green apical half, less clear-cut, but the darker green extending down the outer margin to the hind angle as in the male, where there is some brownish scaling. A minute black dot is present at the upper part of the end of the cell. Hind wing, margin rounder than that of male, with a suggestion of a 'tail' at the end of vein 4; submarginal spots and edge as in the male. *Underside.* Similar to that of male but duller, and the restricted pattern even more obscure.

Range. Sierra Leone to Nigeria.



Map 4.

### *Charaxes eupale latimargo* Joicey & Talbot

### (Pl. 6, figs 65–69, Map 4)

*Charaxes eupale latimargo* Joicey & Talbot, 1921 : 74.
*Charaxes eupale schultzi* Röber, 1926 : 575.

MALE. Fore wing length 30–33 mm. Shape similar to the nominate race. *Upperside.* Fore wing, coloration also very similar, the chief difference being the greater extent of the pale basal area, which extends in the costal area further from the end of the cell, then passes in a curve to the hind angle and nearer to the margin than in the nominate race; there is little or no brownish scaling at the line of junction between the two areas. Hind wing, submarginal dark spotting, though variable in size, is always smaller than in nominate race and the margin of the wing is far less suffused with brownish. *Underside.* Fore wing, very similar to the nominate, but white bars in the cell usually stronger; the brownish marks in the discal line often limited to that in cellule 2, the upper ones hardly visible. The hind wing markings less strong.

FEMALE. Slightly larger than male. Fore wing less pointed, hind wing more rounded. *Upperside.* Dark portion of fore wing less strongly defined from basal pale area; submarginal spots of hind wing less strong. *Underside.* Pattern less strong.

RANGE. Cameroun, Central African Republic, Republic of Congo, Gabon, northern Angola, Congo (Kinshasa), Uganda and north-western Kenya to the Nairobi area, southern Sudan.

### *Charaxes subornatus subornatus* Schultze

### (Pl. 6, figs 70 & 71; Map 4)

*Charaxes subornatus* Schultze, 1917 : 82.

MALE. Fore wing length, 34–35 mm. *Upperside.* Fore wing, general scheme of coloration and pattern as in *eupale*, but pale basal areas more extended, more as in the female of *dilutus*, but the line of junction of the two basic colours commencing well beyond the end of the cell in a curve, thus encroaching on the inner border of the darker green apical area, especially noticeable on the border in areas 1b-3, and not reaching the margin in 1a. There is the usual black spot in the upper part of the end of the cell. Hind wing, pale greenish white with less satiny sheen than the fore wing; the submargin with limited black spots from 3 to the anal angle, the twin spots at anal angle with white centres. *Underside.* Fore wing, duller pale green ground shading to white on the hind area in 1a-1b; a silvery white bar, slightly outlined in black, with a black dot in subcosta, crosses the cell at about mid-point, and extends to 1b, the black dot of the upperside slightly represented; the disc of the wing crossed by a silvery white bar with irregular borders which extends from the costa to vein 2, the outer edge of the bar outlined in black, with some black scaling beyond and some brownish scaling in mid lower part; postdiscal silvery spots, with black marks distally, extend from the subapex to 1b where the black marks are distinct, and in addition, there are two black dots on the submargin of 1b which are characteristic. Hind wing, ground colour pale dull greenish white with a few white scales forming a narrow line in the sub-base; the disc crossed by an almost silvery white bar edged in black proximally, the outer border with black and brownish scaling irregular; the submargin with obscure whitish spots with black dots, with a series of obscured whitish triangles on the admargin, which have punctiform black dots, the spot at the anal angle larger, with white dot in the centre; extreme edge brownish.

FEMALE. Larger than male. Fore wing less pointed, hind wing more rounded. *Upperside.* Pattern less defined in both fore and hind wing. *Underside.* Similar to male but less strong.

RANGE. Cameroun, Central African Republic, Republic of Congo, and in the Kasai district of Congo.

## ***Charaxes subornatus minor*** Joicey & Talbot

### (Pl. 6, fig. 72; Map 4)

*Charaxes subornatus minor* Joicey & Talbot, 1921 : 74–75.

MALE. Fore wing length 28–32 mm. *Upperside.* Fore wing as in nominate race, but the basal pale area not so curved distally, the junction with the darker apical area being more even, but encroaching into the margin of 1b and reaching the edge in 1a. Some specimens have a faint trace of black dots in submarginal line in 4–7. Hind wing as in nominate race. *Underside.* Silvery bars as in nominate race, the black spots on admargin 1b of fore wing, well marked.

FEMALE. *Upperside.* Differences between sexes less marked than in nominate race, but fore wing less pointed and hind wing more rounded. *Underside.* Pattern less strong.

RANGE. Eastern Congo (Kinshasa), in the region of Epulu and the Ituri Forest and Semliki Valley, extending into Uganda in the Bwamba Valley and in the Kigezi district of south-western Uganda; also present in central Uganda and north-western Kenya in the Elgon area. It was also recorded from the Nairobi area by Talbot, but this needs verification. This race of *subornatus*, therefore, has a considerable overlap with *Ch. eupale latimargo*, and *Ch. dilutus*; also with *Ch. montis* in the Kigezi area of Uganda.

## ***Charaxes dilutus dilutus*** Rothschild

### (Pls 6 & 7, figs 73–76; Map 4)

*Charaxes eupale dilutus* Rothschild, 1898 : 97.
*Charaxes dilutus* Rothschild; Joicey & Talbot, 1921 : 69.

MALE. For wing length 30–32 mm. *Upperside.* Fore wing, basal area pale greenish white with a strong satiny sheen particularly toward the base, distal half matt green, the line of junction of the two, commencing at the costa beyond the end of the cell, is zigzag particularly in its lower half where it crosses 1b–3, the green colour extending to the margin of 1a at hind angle. There is the usual small black dot at the upper end of the cell and there are obscure dark dots in the discal line and also in the postdiscal line; the lower part of the margin with brownish tinge especially at angle. Hind wing pale greenish white to margin, which has a narrow brownish edge and on the submargin there is a series of brownish spots with black spots distally which vary in size, the anal spot double and sometimes white-centred. *Underside,* fore wing dull pale green, shading to whitish on 1a and on the greater part of 1b. Base of costa brownish. The cell is crossed by a silvery bar extending from costa and slightly into 3, this bar sometimes with brownish scales intermixed; in the discal line a mixture of silvery and brownish scales strongest in 2–3, with a varying amount of black on margins of these marks; postdiscal row of rather obscure white spots with black distally extends from apex to 2; submargin with obscured whitish spots in 2–5. Hind wing dull pale green, the sub-base with a few silvery scales in no fixed pattern; the disc crossed by a silvery bar outlined narrowly in black proximally, and with some brown scaling distally; a rather obscured series of white and black dots are present in the submarginal line. The underside marks are more visible if the insect is held up to the light.

FEMALE. Larger than the male, fore wing length 33–35 mm. Compared with the male, the shape of fore wing less pointed; the apical darker green less deep in colour, the line of junction of the two basic colours as in the male. The hind wing is slightly paler but submarginal dark spots are similar and equally variable.

RANGE. Malawi, Zambia, western Katanga and eastern Angola, and in Tanzania at Kigoma on the north-east of Lake Tanganyika.

## *Charaxes dilutus ngonga* subsp. n.

(Pl. 7, figs 77–79; Map 4)

Male. Fore wing length 28–30 mm, thus smaller than nominate race. *Upperside.* Fore wing, the pale greenish white ground colour is less green than in nominate, especially in the females; the apical green with a similar inner border. On the hind wing the submarginal blackish spots are slightly larger and the marginal border wider, with some brownish olive scaling proximally. *Underside.* Markings are similarly placed, but slightly less dark in the lower discal line, and the whole ground colour has a more silvery bloom, less greenish.

Female. Fore wing length 32 mm. *Upperside* and *underside* similar to those of male, except that the submarginal series of brownish spots on upperside of hind wing is not so well developed and prominent.

Holotype ♂. Kenya: Ngong. Bred x. 1956 (*van Someren*).
Allotype ♀. Kenya: Ngong. Offspring emerged iv, v. 1956.
Paratype ♂. Kenya: [+ an illegible word].
Paratype ♀. Kenya: Ngong, iv. 1956 (*van Someren*).
Types and paratypes in BMNH.

Range. Kenya, especially in the Highland area around Nairobi and Kikuyu to Mt Kenya and the Aberdares; a very similar form occurs in the Kigezi highlands of Uganda. *Charaxes dilutus* is recorded from southern Sudan (*Wilson*) but I have been unable to examine specimens; Carpenter also records *eupale latimargo* from the same area.

## *Charaxes montis* Jackson, stat. n.

(Pl. 7, figs 80, 81; Map 4)

*Charaxes dilutus montis* Jackson, 1956 : 67.

Described as a subspecies of *Charaxes dilutus* on the basis that the genitalia have a similar shaped uncus (*teste* Bennett), the insect is here raised to specific rank because of marked macroscopical differences, and the fact that *Ch. dilutus* occurs in the Kigezi district along with *montis*, as also does *eupale latimargo*.

Male. Fore wing length 29–30 mm. Shape distinctive, the apex very pointed and the outer margin strongly incised at 4–5, giving a falcate appearance, more so than in any other species of the group; moreover, the antennae are black. *Upperside.* For wing, basal pale area greenish white with a yellowish tinge to the satiny area at the base of the wing; apical portion wing darker matt-green, the line of junction between the two areas runs in a curve from beyond the end of the cell, where the costa is also green, passing obliquely through the sub-bases of 5–4, then, with a slight kink to 3, decreases rather rapidly to vein 2, extending to the hind margin in almost even width; the margin of the wing slightly darker. There is only the faintest trace, or no spot, at the upper part of the end of the cell; the discal black spots and those in the postdiscal line equally faint. Hind wing, pale greenish white with slight creamy tinge, immaculate, except for an admarginal row of white-centred black dots, that in 3 triangular and largest; edge with brownish black continuous lunules. *Underside.* Fore wing, pale matt-green shading to paler whitish in 1a–1b; silvery white bar through sub-base of cell crosses into base of 2; discal silvery bar, widest at the costa and 6, 4 mm, takes a slight kink and tapers to the dark spot in discal line at 2; obscure white spots are present in the postdiscal line, those toward the apex more distinct and black on distal side; admargin with rather diffuse white spots, largest at 2–4, become obscure above, but may coalesce and touch the outer margin; there is a sprinkling of white scales present at the base of the wing between the two silvery bars and between the discal bar and the marginal white in 2–3. Hind wing, ground colour dull light green; a brownish spot present in the cell with a trace of one in space below; discal line of brownish spots, largest at 3, have black lines or spots distally; submarginal row of white and black spots faintly indicated; admarginal black dots with white surround more visible; extreme edge slightly brownish.

FEMALE. Larger and paler than the male, fore wing length 31 mm. *Upperside.* Fore wing, the green apical portion even more restricted than in the male, and tapering rapidly to 2, is represented on the margin by a thin brownish olive line, which only just reaches 1a. The hind wing is almost immaculate except for black dots on the admargin visible in 2–3 and at anal angle; edge narrowly shaded with brownish black. *Underside.* Paler than the male, more silvery overall, and spots very subdued.

RANGE. Uganda, Kigezi district, in the high Mafuga Forest at 8,000–9,000 ft and in the upper Impenetrable Forest where it occurred in some numbers; it was less plentiful in the Kayonza area. As with other members of this group, females are less in evidence.

## SYSTEMATIC LIST

### ***Charaxes eupale*** (Drury)

*Charaxes eupale eupale* (Drury), 1782. Type locality: Sierra Leone.
Range: Sierra Leone to Nigeria.

*eupale latimargo* Joicey & Talbot, 1921. Type locality: Bitje, Cameroun.
Range: Cameroun, Central African Republic, Republic of Congo, Gabon, northern Angola, Congo (Kinshasa), Uganda, north-western Kenya to Nairobi area, southern Sudan.

### ***Charaxes subornatus*** Schultze

*Charaxes subornatus subornatus* Schultze 1917. Type locality: Cameroun.
Range: Cameroun, Central African Republic, Republic of Congo and in the Kasai district of Congo.

*subornatus minor* Joicey & Talbot, 1921. Type locality: Mabira Forest, Uganda.
Range: E. Congo (Kinshasa) in Epulu region and Ituri Forest and Semliki Valley; Uganda, Bwamba Valley and Kigezi district, C. Uganda and N.W. Kenya in Elgon area. There is a doubtful record from the Nairobi area.

### ***Charaxes dilutus*** Rothschild

*Charaxes dilutus dilutus* Rothschild, 1898. Type locality: Zomba, Malawi.
Range: Malawi, western Katanga and eastern Angola, Tanzania, Kigoma district, southern Sudan, Zambia.

*dilutus ngonga* subsp. n.
Range: Kenya Highlands, Nairobi and Kikuyu to Mt Kenya, the Aberdares, Uganda, Kigezi district.

### *Charaxes montis* Jackson

*Charaxes montis* Jackson, 1957. Type locality: Kigezi district, Uganda.
Range: Uganda, Kigezi Province at Mafuga and Impenetrable Forest, Kayonza.

## 5. The *CHARAXES ZOOLINA-NEANTHES, KAHLDENI-HOMEYERI* Complex

In this complex we have two species, each exhibiting very similar so-called 'seasonal forms', a pale greenish-white form and a brown form. Though the two species have a very generally similar appearance, they must be considered as distinct, since there is considerable overlap in distribution of the several races. Thus for example, *kahldeni* overlaps with *zoolina ehmckei* in Angola, and *kahldeni* with *zoolina* in western Uganda. Not only do the two 'seasonal forms' of these two species seem to have developed along parallel lines, and intermediates between 'wet and dry' have been taken, and the two forms found 'in cop.', which clearly indicates the conspecificity of the forms, but also the distinctness of *kahldeni* from *zoolina*, and the distribution of the two, supports this view.

### *Charaxes zoolina* (Westwood)

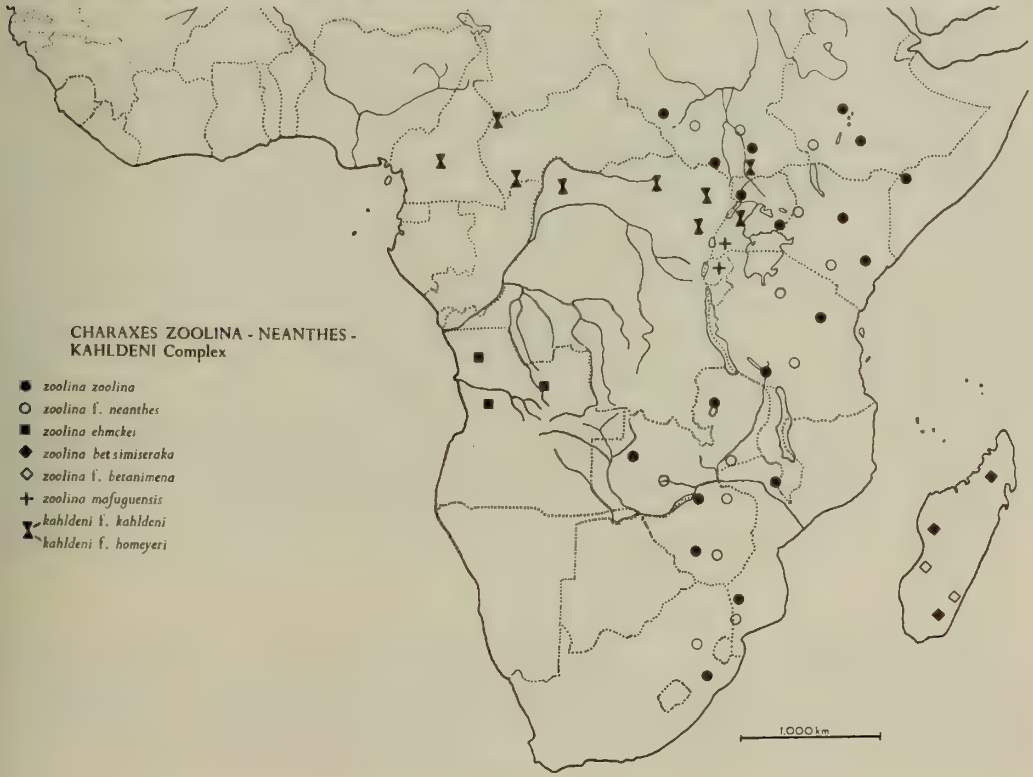
(Pls 7, 8, figs 82–92; Map 5)

*Nymphalis zoolina* Westwood, 1850 : 309, pl. 53, fig. 1.
*Charaxes zoolina* (Westwood) Trimen, 1862 : 341.

### Form **zoolina** Westwood

Male. Fore wing length, 28–30 mm. Fore wing, costa slightly curved, outer margin incised 2–4, apex falcate but square-cut at end. *Upperside*. Fore wing, base of costa brownish, shading to black beyond; basal area creamy with greenish tinge, base smoky; apex and border black, the black extending down the subcosta into the cell, which has a strong black bar at end with an extension into base of 3 and sub-base of 4, this bar connected up with the black of the apex; base of cell smoky, reducing the pale ground into blunt curved points. Pale spots in 5–7 variable in number and size, that in 6 always present; submarginal row of whitish spots may extend from subapex to 2 but usually ends at 3. There is an indication of the dark bar of the lower side showing through in the discal line in 1b and 2. Hind wing, ground colour creamy with stronger greenish tinge at base of wing, the inner fold paler, but with dark shading at upper border especially toward the hind angle, where there is a pale triangular spot; dark line of underside showing through in discal line; border black, tapering toward the anal angle; submargin with whitish spots, which may be distinct and complete or limited to those in the curve; admarginal line rufous, strong or faint, shading to olive-ochre at anal angle which carries two blue-centred black spots; margin of wing very slightly dentate but no tail on 4, that on vein 2 black with white central line, spatulate at end, 6–7 mm in length. *Underside*. Fore wing, more greenish tinged with a distinct satiny gloss. Base of costa with silvery white spot or line; cell with dark bar at sub-base, the bar at end strong and often connected with the inner arm of the postdiscal dark line by black veins; postdiscal dark bar strong, extending from costa to within hind angle; submarginal row of satiny white spots complete, followed by a narrow line of linear marks along the admargin; margin of wing slightly browner but edge narrowly black. Hind wing, ground colour as fore wing, sub-base of wing with a thin curved line joining up with the inner arm of the strong dark Y-shaped bar, the outer arm joining with the inner along the upper edge of the inner fold, with darkened veins extending to a cross-line above the anal angle, which has a triangular white spot; border of wing more brownish, carrying a submarginal row of whitish and dark spots at anal end; admargin with larger silvery white spots, black-ringed toward the anal angle; border with ochreous orange line shading to olive at the anal angle, which has the usual twin black spots with lilac centres; edge of wing black.

FEMALE. Larger than the male, fore wing length 30–32 mm. Outer margin less incised. *Upperside.* Fore wing, ground colour creamy with greenish tinge, especially toward the base; pattern less heavy than in the male, and tending to be broken up, the dark bar at end of cell more tapering and not extending to 2, the dark bar beyond in sub-bases 5–6 may be strong or faint; the dark wavy line from subapex to within hind angle variable, fading out in 1b; the blackish border heaviest at apex tapering toward the hind angle, the enclosed white spots largest at the subapex and solitary, the rest diminishing in size to the hind angle. Hind wing, ground colour as fore wing; with dark lines of underside showing through; border variable on inner edge, usually interrupted at mid areas; submarginal whitish spots large at upper angle but diminishing in size toward the double spot at the anal angle; admargin ochreous orange, shading to olive at anal angle; edge black. Tails on 4 & 2, 5 & 7 mm in length with spatulate ends. *Underside.* Fore wing, ground colour as above but slightly paler and with a satiny sheen



MAP 5.

extending to the margin of the wing. Pattern brownish black, somewhat similar to upperside, but cell with a dark mark at base, a curved line in mid-area, and the bar at its end extending into sub-bases of 2 and slightly into 1b. The line through sub-bases of 8–6 variable in width with a trace of marks in 2–3; submarginal dark sinuous line strong in subapex narrowing toward the hind angle; pale spots beyond, relatively large, bordered distally by the admarginal line of lunules; margin brownish, edge narrowly black, with white dot at end of veins. Hind wing ground colour as fore; pattern much as in the male, but less black; submarginal row of lunules edged black proximally, strongest toward anal angle; admarginal line of larger pale spots with black distally also heavy at the anal angle; border ochreous orange, edged with black. Anal angle with lilac-centred black spots on an olive ground.

The above descriptions are taken from a series of specimens obtained in Kenya and Uganda, and are representative. Marked variants occur and appear to be commoner in the South Kavirondo area of Kenya (Pl. 7, figs 82 & 84). They are characterized by enlarged white spots in the apical portion of the fore wing and enlarged spots in the hind wing border. This variation occurs in both sexes. It is here also that intergrades between *zoolina* and f. *neanthes* are sometimes taken (Pl. 7, fig. 83).

### Form ***neanthes*** (Hewitson)

(Pls 7 & 8, figs 87–92; Map 5)

*Nymphalis neanthes* Hewitson, 1854 : (3), pl. 45, figs 1–3.

MALE. Fore wing length 25–28 mm. Shape as in nominate form, but apex often less falcate, and end more bluntly rounded. *Upperside.* Fore wing, ground colour ochreous to tawny orange. Pattern very similar to that of *zoolina* but dark areas are rusty brown, not black; the pale spots on the submargin of wing, larger. Hind wing, ground colour as fore wing, dark markings rusty brown; pale admarginal spots ochreous, shaded with black distally; anal angle with double spots variable in size. Single tail at 2, 5–6 mm in length, with spatulate end, the base of the tail merged into the prolonged anal angle. *Underside.* Fore wing, ground colour rather variable, ochraceous to rusty ochreous, almost uniform or strongly freckled with dark scales. Pattern may be almost entirely obscured or with a dark brownish black discal line edged with white proximally crossing both wings. Fore wing usually with obscured punctiform dark spots in submarginal line; edge of wing darker brownish. Hind wing, pattern obscured, though it may be well marked in form with dark discal line, but usually with a row of dark punctiform spots on the admargin. Veins greenish.

FEMALE. Larger than the male, fore wing length 30–35 mm; shape as in form *zoolina*. *Uppersides.* Fore wing, ground colour ochreous-orange but paler than in the male; pattern variable but usually faintly indicated, the dark marks rusty brown; the dark marks of underside, if strong show through in the discal line. Tails well developed, upper 5–6 mm, lower 7 mm. *Underside.* Fore wing, ground colour varying from a pale ochreous to tawny ochreous with a matt surface. Pattern almost entirely subdued even to the discal line, but this is usually strong on both wings. Tails usually brown.

Minor forms have been described, such as *homochrous* Le Cerf (1923 : 429) and *obscuratus* Suffert (1904 : 123). The two main forms, though considered 'seasonal' in some areas, can be taken in the same locality, at the same time, throughout the greater part of its range. When sufficient material has been collected from the outlying districts of its range, it may be possible to recognize local races, other than those mentioned in this review.

RANGE. Described from Natal, the nominate form and form *neanthes* range from the eastern coast of South Africa through Mozambique, Zambia, Rhodesia and Malawi to Tanzania, Kenya, Uganda, southern Sudan, Ethiopia and the Somali Republic.

### ***Charaxes zoolina mafugensis*** Jackson

(Pl. 8, figs 93–96; Map 5)

*Charaxes zoolina mafugensis* Jackson, 1956 : 67.

This subspecies was based only on the male sex of the *neanthes*-like form of this race; it is mainly characterized by the very dark borders of both wings, compared with the male form *neanthes* of the nominate race.

#### The '*neanthes*'-like form

(Pl. 8, fig. 93)

MALE. Fore wing length 28–30 mm; shape as in the nominate f. *neanthes*. *Upperside*. Fore wing, ground colour richer rufescent orange, border of wing darker rusty brown, base of wing with a slight olive tinge. The short dark bar at end of cell, sometimes continued into sub-base of 2, slightly broader; bar in sub-bases 5–6; the dark border, enclosing submarginal spots which show up distinctly against the dark ground, extends from the subapex to 1b. Hind wing, ground colour as fore wing, paler on the inner fold; border dark as on the fore wing, clearly demarcated from the orange by a zigzag dark line commencing at the costa and extending to above the hind angle, on its distal side a series of blackish lunules distally bordered by a row of paler indistinct spots; border dark rufous brownish with a series of rather obscure dark marks, most distinct on the hind margin above the anal angle with its double spots on an ochreous olive ground. Tail at end of vein 2 with spatulate end, 7 mm in length. There is sometimes a dark line along the lower part of the inner fold arising from above the hind angle. *Underside*. Fore wing, ground colour darker and richer rusty-brown than nominate *neanthes*. Pattern if present, variable, from almost uniform brown with only a trace of dark marks along the costa to well marked bars through the disc of fore wing and also on the hind wing.

FEMALE. Fore wing length 30–32 mm; shape as in nominate *neanthes* female. *Upperside*. Fore wing, ground colour paler than the male, tinged with more olive at base.

Pattern as in the male, but postdiscal line of blackish lunules more angled proximad in 3, with consequent larger submarginal orange spots; border dark rusty brown. Hind wing, ground colour paler than that of male, the inner fold paler and tinged with greenish; the distinct row of dark lunules more proximad with larger, more distinct spots on the border; admargin brownish and angled at 4 to accommodate the upper tail, 6 mm in length, lower 7–8 mm. *Underside*. Fore wing, paler than that of male, more russet; pattern obscured except for the dark bar in the fore wing, which continues through the hind wing to hind angle. Hind wing, admargin with punctiform dark spots; edge of wing darker extending onto tails.

#### The '*zoolina*'-like form

(Pl. 8, figs 94–96)

MALE. Fore wing length 28–30 mm; shape as in nominate *zoolina*. *Upperside*. Fore wing, ground colour creamy white with greenish tinge, especially at base; pattern as in the nominate race but white area more extended distad toward the hind angle. Black mark at end of cell variable, heavy or reduced, but white spots within the black border larger, especially those in sub-bases 5–6. Hind wing, with extended white area distad, reducing the width of the black border, but the contained white spots, larger. *Underside.* Fore wing, ground colour more greenish white and more extended; fore wing cell with only one black line. Hind wing with extended white areas but black marks stronger, that on submargin straighter and nearer the border; admarginal spots reduced.

RANGE. Uganda, in the south-western district of Kigezi, especially in the Mafuga Forest, which is part of the Impenetrable Forest, at 8,000–9,000 feet; but also found in the Lower Kayonza Forest.

## ***Charaxes zoolina ehmckei*** Dewitz

*Charaxes ehmckei* Dewitz, 1882 : 382.
*Charaxes zoolina ehmckei* f. *phanera* Jordan, 1908 : lxix.

MALE. Fore wing length 30 mm; shape as in *neanthes*. *Upperside.* Fore wing, superficially resembling the female of *zoolina betsimisaraka* form *betanimena* Lucas, of Madagascar, the basal area being white with a greenish yellow tint, the rest of the fore wing more ochreous; the border, at line of junction tawny, the rest brownish black with the postdiscal and submarginal spots well marked and ochreous in colour; a faint dark line present at end of cell. Hind wing, basal area as fore wing; inner fold paler; border brownish black with sinuous inner edge, tapering toward the tail; the two rows of ochreous spots obscured. Tail at vein 2 as in other males of the species. *Underside.* Much as in *neanthes*, but median band vestigial.

FEMALE. No specimen available.

RANGE. Angola, at Pungo Andongo.

## ***Charaxes zoolina betsimisaraka*** Lucas

(Pl. 8, figs 97–100; Map 5)

*Charaxes betsimisaraka* Lucas, 1872 : 3.
*Charaxes relatus* Butler, 1880 : 354.
*Charaxes zoolina betsimisaraka* f. *firmus* Le Cerf, 1923 : 429.

### Form ***betsimisaraka*** Lucas – the '*zoolina*'-like form

MALE. Fore wing length 29–32 mm; shape as in nominate *zoolina* but with deeper curve to outer margin and more protruding hind angle, where at vein 2 there is a definite projection. On the hind wing there is an even more marked 'tail' at vein 4 and the anal angle is more prolonged. *Upperside.* Fore wing, ground colour more creamy white, the base of the costa and base of cell slightly brownish; the bar at the end of the cell not extending into area 3; the creamy spots in the black border, though variable in size and number, always clear. The dark mark of underside in the discal line may show through in 1b & 2. Hind wing ground colour creamy, slightly more buffish on inner fold, shading to brownish at the hinder part; the black border relatively wide and extending to the anal angle; the submarginal spots small, double at anal angle; the admargin with rufescent angular spots, olive at anal angle; edge black; tail spatulate, black, with whitish mid line 10 mm in length. *Underside.* Fore wing, ground colour creamy, with some satiny patches, particularly on the border; base of cell brownish black, a short blackish bar at mid point and a stronger bar at end of cell, extending into subbases of 3 and 2; postdiscal blackish bar strong, dividing into two at 4, the angle containing three white spots; border of wing brownish and the submarginal series of white spots complete from the subapex to 1a; submarginal series of smaller spots also complete. Hind wing, ground colour creamy, with satiny sheen; sub-base with a dark curved line; disc of wing crossed by a darker bar and joining the inner arm of the 'Y' along the inner fold, at the lower end of which is a thin line crossing the fold. Border brownish, with a row of black lunules in the submarginal line; admarginal silvery white spots well marked, especially at the upper angle, accentuated by black distally; enlarged black mark at anal angle, flanked by olive and with lilac centre. Margin satiny brownish, edge black.

FEMALE. Fore wing length 32–36 mm. Shape as in nominate *zoolina*. *Upperside*. Fore wing, very similar in markings and greenish white ground colour to nominate *zoolina*, except that the dark bar at end of cell is slightly thinner and the two blackish spots situated mid way between cell bar and the dark subapical area are reduced in size, or sometimes obsolete. The pale submarginal spot in space 3 is only slightly larger than that in space 2 and has a straighter inner margin, so that the dark brown of the postdiscal line is less sinuous and tends to run parallel with the outer margin. Hind wing, as in nominate ssp. but the submarginal series of spots are more noticeably darkened inwardly. *Underside*. Compared with nominate *zoolina* the dark markings are darker. Fore wing, mid-cell bar irregular and tending to be broken in two. The spot in space 3 of inner submarginal series is only slightly larger than those in spaces 2 and 4 so that the brown line separating these spots from the disc is straighter and it extends beyond vein 1 towards the tornus. Immediately below vein 5 this brown line extends basad and tends to join with the postdiscal costal bar. Hind wing, the dark brown submarginal line tends to be broader and darker, with black lunules on its inner margin and with little indication of an internal series of paler spots.

RANGE. Confined to Madgagascar.

### Form *betanimena* Lucas

(Pl. 8, figs 99 & 100; Map 5)

*Charaxes betanimena* Lucas, 1872: 3.
*Charaxes andriba* Ward, 1873: 210.
*Nymphalis freyi* Branczik, 1891: 161.
*Charaxes lambertoni* Lathy, 1925: 96.

MALE. Fore wing length 28–30 mm; shape as in nominate form, the margin of the hind wing with marked tooth at end of vein 4. *Upperside*. Fore wing, pattern also very similar but ground colour strongly suffused with ochreous; apex and outer border brownish black, the enclosed spots ochreous orange; the dark line at end of cell narrow. Hind wing, ground colour as fore wing, inner fold more buffish; border relatively wide, blackish at upper angle but shading to more rufous toward the hind angle; enclosed ochre-orange spots complete, edged with black distally; edge of wing more rufous; anal angle with olive ground carrying double black spots. Upper 'tail' clearly visible, 2 mm, lower tail 5 mm, slightly curved and spatulate at end. *Underside*. Fore wing ground colour cinnamon to rufous, paler on the border; costa silvery at base; pattern very faint except for a slight dark line in cell and the dark discal bar, edged white proximally; submarginal dark spots punctiform. Hind wing, ground colour as fore wing, pattern obscured except for the dark transverse discal line, white edged proximally, and extending from costa to hind angle; a slight indication of a dark line along vein 2 on the inner fold; submarginal line very faint, and admarginal dots almost obscured; anal angle olive with two black dots.

FEMALE. Larger than the male, 35 mm; shape, outer margin not so incised, but apex more 'cut-off', with lower angle more acute. *Upperside*. Fore wing, ground colour creamy with greenish ochre tinge; border brownish black and broad, enclosed pale spots, large beyond cell and in 3, but rest rather small; mark at end of cell narrow. Hind wing, ground colour as fore wing but shading to buffish on the inner fold; border relatively broad, brownish black; submarginal spots obscured, buffish in colour; admarginal spots paler and more distinct; edge rufous, turning greenish olive at anal angle. Tails spatulate at ends, upper 6 mm, lower

10 mm. *Underside.* Fore wing, ground colour pale to dark russet; pattern obscured except for the dark bar at end of cell and extending to hind margin at 1b; a row of blackish triangular marks in the postdiscal line, followed by obscure pale marks on submargin; margin of wing brownish, edge narrowly black. Hind wing, ground colour as fore wing, discal bar with white proximally, fairly strong, extending from costa to anal angle where it joins with the postdiscal line of more obscure dark spots; admarginal dark spots black becoming linear at tails, and more distinct; edge of wing slightly rufous.

Range. Confined to Madagascar where both forms are widespread; the nominate form seems to be the more abundant.

## ***Charaxes kahldeni*** Homeyer & Dewitz

(Pl. 8, figs 101–105; Map 5)

*Charaxes kahldeni* Homeyer & Dewitz, 1882 : 381.

Male. Fore wing length 28–30 mm; shape, costa curved toward end, apex projecting, but end squared off; outer border incised, hind angle projecting slightly at 1b. Hind wing outer margin rounded but anal projection strong. *Upperside.* Fore wing, ground colour creamy, with greenish tinge, slightly satiny toward base; costa slightly brownish at base, black beyond. A small black spot at upper end of cell and another slightly larger at base of 6. Apex and border of wing black, enclosing a subapical white spot of varying size and a series of submarginal larger spots extending from the hind angle at 1b to 4, the lower spots only partially enclosed proximally. There is a slight indication of a dark line crossing the base of the wing from the cell to lb, enhanced by the dark line of underside showing through. Hind wing, ground colour as fore wing, immaculate except for a very narrow blackish border at margin, and an indication of black lines in the admarginal line, the marks becoming spots with blue centres, double at anal angle on a buffish ground; single long tail with spatulate end of vein 2, 7–8 mm in length. *Underside.* Fore wing, ground colour as upperside, costa all black; pattern as upperside but stronger and darker, with an additional black dot conjoined to costa in cell, the bar beyond strongly represented, as well as a dark bar in the postdiscal line, but the marginal border not so black except at edge, admarginal series of linear marks not so strong but extending to subapex. Hind wing ground colour as fore wing, pattern strong but limited to a 'Y'-shaped mark, the inner arm extending from the base of the wing to mid-point 1c, the outer arm from mid-costa, through end of cell and joining the inner arm and continuing down the upper edge of the inner fold to the anal angle; an almost straight bar crosses the submarginal zone of the wing from the costa to the anal angle, which has the usual blue-centred black marks on an olive ground. Admargin with very fine dark line; edge blackish; tail mostly black.

Female. Larger than the male, fore wing less incised on margin, end of apex square-cut. Hind wing not so angled at hind angle, but upper part of outer margin almost straight, ending in a projection at vein 4 to accommodate a second tail, the wing then tapers to the anal angle. *Upperside.* Fore wing, pattern limited to an indication of dark scaling at end of cell; the postdiscal dark line, though strong in the subapex, ends at 4, but is extended to 1b by the dark line of underside showing through; apex and margin blacker, wide at apex but tapering to 1b; the pale spot in the subapex free or conjoined to the submarginal ground colour. Hind wing, ground colour as fore wing, immaculate except for indications of the dark lines of underside showing through; edge narrowly black, the black extending up the tails; with additional admarginal black linear marks between tails and the anal angle, those at angle with lilac centres on a buffish olive ground. Tails spatulate upper 5 mm, upwardly curved, lower 8 mm, downwardly curved. *Underside.* Fore wing, ground colour as in the male, dark markings similarly placed. Hind wing, ground colour and markings as in the male but with an additional dark line on the bottom edge of the inner fold and joining with the base of the stalk of the 'Y'-mark, but leaving a long triangular whitish mark above the anal angle. Tails black.

### Form ***homeyeri*** Homeyer & Dewitz

### (Pl. 8, figs 104 & 105; Map 5)

*Charaxes kahldeni* f. *homeyeri* Homeyer & Dewitz, 1882 : 382.

MALE. Fore wing length 26–30 mm; shape similar to nominate form, but outer margin sometimes more incised. *Upperside.* Fore wing, ground colour of base of wing and costa pale creamy with greenish tinge, shading into the orange of the distal half, where the only pattern noticeable is a dark spot at upper end of cell, a darker marginal border and an obscure submarginal line, the two lines enclosing obscured spots of the ground colour. *Underside.* Fore wing, ground colour pale rufous russet; costa silvery at base; the base of the wing crossed by a strong blackish bar, commencing at costa at end of cell and extending to upper part of 1b, proximally accentuated with a silvery white line. Hind margin of wing whitish; a series of punctiform blackish spots present in the postdiscal line, double in 1b, on veins. Hind wing, ground colour as fore; the only pattern is the dark 'Y' at basal half of wing as in nominate form, the inner arm less strong, the outer accentuated by a silvery line on the proximal side. A series of dark dots present in the submarginal line and punctiform dark dots on the admargin, double at the anal angle where the ground colour is tinged olive.

FEMALE. Larger than the male, fore wing length 35 mm; shape, outer margin of fore wing less incurved and straighter, thus apex less acuminate. General coloration and pattern similar to that of the male, but hind wing with well developed tail at 4, with the marginal border between tails darker. *Underside.* Very similar to that of male, but ground colour and pattern stronger.

RANGE. Described from Angola, this species ranges north to the Cameroun, the Central African Republic, Republic of Congo and mid-Congo (Kinshasa) to western Uganda, overlapping with *Charaxes zoolina.*

## SYSTEMATIC LIST

### ***Charaxes zoolina*** (Westwood)

*Charaxes zoolina zoolina* (Westwood, 1850). Type locality: Natal.
Range: Natal, Zululand, Manicaland, Zambezi, Zambia, Rhodesia, Tanzania, Kenya, Uganda, southern Sudan, Ethiopia, Somali Republic.
f. *neanthes* (Hewitson, 1854). Type locality: Natal.
Range: As above.
f. *homochrous* Le Cerf, 1923. Type locality: Lourenco Marques.
f. *obscuratus* Suffert, 1904. Type locality: Mhonda.
*zoolina ehmckei* Homeyer & Dewitz, 1882. Type locality: Pungo Andongo, Angola.
f. *phanera* Jordan, 1908. Type locality: N. Angola.
Range: Angola.
*zoolina betsimisaraka* Lucas, 1872. Type locality: Madagascar.
f. *betanimena* Lucas, 1872. Type locality: Madagascar.
Range: Madagascar.
*zoolina mafugensis* Jackson, 1957. Type locality: Mafuga, Uganda.
Range: Uganda, Kigezi District, high forests of Mafuga.

### ***Charaxes kahldeni*** Homeyer & Dewitz

*Charaxes kahldeni* Homeyer & Dewitz, 1882. Type locality: Pungo Andongo, Angola.

Range: Angola, Republic of Congo, Central African Republic, Cameroun, Congo (Kinshasa) to Uganda.

f. *apicalis* Röber, 1925. Type locality: southern Cameroun.

f. *homeyeri* Homeyer & Dewitz, 1882. Type locality: Pungo Andongo, Angola.

f. *bellus* Niepelt, 1914. Type locality: Cameroun.

Range: As above.

## 6. THE ***CHARAXES PORTHOS–ZELICA*** COMPLEX

The members of this complex form a compact group with a characteristic shape. The males are tail-less, but in some species the females have one well developed tail.

The first species of the group, *Charaxes laodice*, was described by Drury in 1782. In general shape and underside pattern, the species appear related to *Charaxes nichetes* Grose Smith and its subspecies, which occur in more open habitats and are tawny orange in colour.

Unfortunately, little or nothing is known of the early stages . . . ova, larvae, pupae and the food plants have not been recorded, so far as I know. When this information is forthcoming, it will show whether or not the present grouping is correct.

The species are confined to heavy forest, and the males are frequently noted sitting on some exposed twig, sunning themselves, in forest clearings.

### ***Charaxes mycerina*** Godart

(Pl. 9, figs 106–108; Map 6)

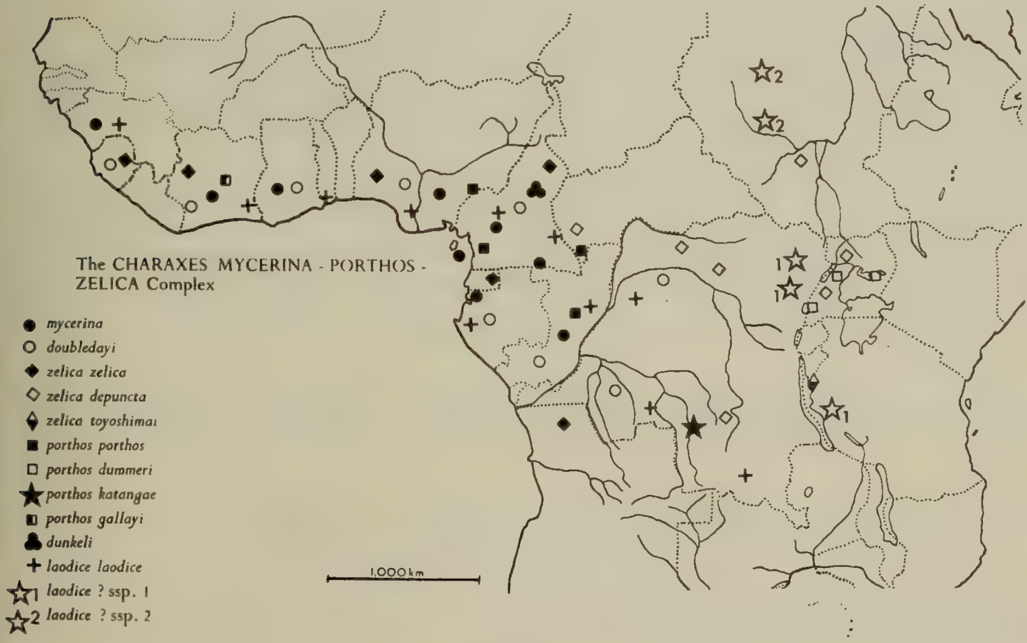
*Charaxes mycerina* Godart, 1824 : 369.
*Charaxes nausicaa* Staudinger, 1891 : 137.

MALE. Fore wing length 36–37 mm. Shape, apex tapering, but tip rounded; outer margin deeply concave at 3–5, and hind angle projecting at vein 2. *Upperside*. Fore wing, ground colour deep blue-black; cell almost entirely blue to its end, which is black; two elongate discal spots in contact beyond the cell, the upper smaller, followed by a postdiscal series arranged in a curve from 5 to hind margin in 1a, but no spot in 4, there may be a minute blue dot slightly off-set; the four lower spots increasing in size from 3, the mark in 1a, elongate. Hind wing, ground colour blue-black, shading to black on the inner fold. There is a minute white dot at the base of 5; the disc of the wing crossed by a series of blue spots of increasing size from subcosta at 6, more or less isolated, the others contiguous, stopping short at the inner fold. Submargin with minute blue dots in its lower half; margin with interrupted blue lunules from anal angle to 4. Outer border of wing rounded, but anal angle roundly projecting. *Underside*.

Fore wing, ground colour pale brownish grey, darker brownish on the curve of the outer margin. Disc of wing crossed by a darker blackish grey wedge-shaped band, widest at the costa and passing through end of the cell and the bases of cellules beyond, narrowing in sub-base of 2 and extending towards hind margin. This band is narrowly outlined in silvery white. The apex of the wing has a triangular dark patch extending from the costa to 3 and is outlined distally by a silvery line extending from the apex to 2; this line accentuates the dark border. Hind wing, ground colour as fore wing, the median bar slightly darker, outlined narrowly in black and white and crosses from the costa toward the inner fold, where it fades out. This is followed by a silver line dyslegnic on inner border but sharply defined by black distally, crossing the wing from costa to anal angle. This accentuates the darker browner zone between it and the satiny greyish outer border, which is narrowly edged with darker brownish. In between are a few white dots in the submarginal line; the dots at the anal angle are black.

FEMALE. Larger than the male, 39–40 mm. *Upperside.* Ground colour and pattern very similar but black less intense toward the base of the fore wing and along the costal area of the hind wing. The pattern of blue spots like that of the male, the blue in the cell less strong and mixed with black; the spots in the postdiscal line as in the male, the small spot in 5 often more distinct. Hind wing, pattern as in the male, the blue marginal lunules stronger both above and below the strongly developed tail at end of vein 4, which is robust with rounded end, 5 mm in length. *Underside.* As in the male; the dark triangular marks of the fore wing more satiny; the basal portion of the hind wing slightly paler; sub-base and discal zone with thin wavy black transverse lines; the darker browner postdiscal band straighter on its inner edge; the border darker, carrying a series of obscured pale spots in the submarginal line, separate at the upper end but contiguous from 5 to the anal angle. There is a suggestion of a 'tail' on edge at vein 2.

RANGE. Sierra Leone, Ivory Coast, Ghana, Cameroun, Central African Republic, Republic of Congo and western Congo (Kinshasa). Also recorded from the island of Fernando Po.



MAP 6.

## ***Charaxes doubledayi*** Aurivillius

(Pl. 9, figs 110–111; Map 6)

*Charaxes doubledayi* Aurivillius, 1899 : 244.
*Charaxes mycerina* auct. nec Godart, 1824.

For full references *vide* Bryk, 1939 : 91.501.

This species is confusingly like *mycerina*, but can be distinguished by its larger size and the presence of a series of blue spots on the margin of the 'bay' of the fore wing.

MALE. Fore wing length 39–41 mm. Shape, fore wing costa strongly curved, apex bluntly pointed, emphasised by the strong concavity of the margin at 3–5 and the projection of the hind angle at vein 2. *Upperside.* Fore wing, ground colour deep blue-black; a large blue area occupies the basal 2/3rds of the cell of the fore wing, and beyond are two elongate blue spots, set at an angle, the upper one often small; a more oval spot is present in 6, sometimes with small blue dots above and below in 5, no spot in 4, but spots of increasing size are present in the postdiscal line, reaching the hind margin. Margin of wing within the curve with small blue spots reaching as far as 1b. Hind wing, ground colour deep blue-black, shading to blackish brown on the inner fold. The disc of the wing crossed by a strong blue band, widest in 1c on the edge of the inner fold, then tapering rather rapidly to the subcosta in 6 where the spot is often free. Margin with conspicuous blue lunules stopping short of veins 6–7. Anal angle slightly bluish. There is a slight indication of a tail at end of vein 4. *Underside.* Fore wing, very similar to that of *mycerina* but ground colour darker brownish grey; sub-base of wing crossed by a dark band, with a more distinct triangular band, outlined in white, widest at costal end, decreasing in width to the hind margin. Beyond, in the subapex is a triangular dark satiny patch, with irregular inner border which ends at vein 2 and is outlined distally in white. The concavity of the wing darker brownish black extending to the hind angle, bordered internally with obscure pale marks in the submarginal zone. Hind wing, ground colour as fore wing, an indication of a darker triangular band in the sub-base followed by a more conspicuous dark band externally bordered by a whitish brown line, which crosses from the costa to above the hind angle, which is bordered distally by a dark line shading into the dark border, which has obscure pale marks in the submarginal zone surrounding minute white dots; the margin darker brownish.

FEMALE. Larger than the male, fore wing length 43–45 mm. *Upperside.* Colour and pattern as in the male, but ground colour less intense blue-black, especially at the bases of fore and hind wings. The pattern of blue spots similar to that of the male on both wings, but blue border on hind wing more continuous, the blue extending up the well developed tail, which is 6 mm in length and blunt-ended. The anal angle is bluntly rounded, and there is also a slight projection at the end of vein 2. Underside. Very similar to that of the male but ground colour slightly paler brownish grey, especially on the hind wing, and the pattern of both wings is more distinct.

RANGE. Sierra Leone to the Congo (Brazzaville), including Cameroun, Central African Republic and Republic of Congo (Kinshasa).

## ***Charaxes porthos porthos*** Grose-Smith

(Pl. 9, figs 112, 113; Map 6)

*Charaxes porthos porthos* Grose-Smith, 1883 : 57.
*Charaxes midas* Staudinger, 1891 : 135.
*Charaxes porthos porthos* Grose-Smith; van Someren, 1968 : 225.

Male. Fore wing length 36–38 mm. Shape, fore wing costa rather curved, apex bluntly pointed, tip rounded; outer margin strongly concave in 3–5; hind wing rounded but anal angle slightly produced. *Upperside.* Fore wing, ground colour blue-black, usually with a blue subcostal spot beyond end of cell, which may be single or double. Wing crossed by a series of blue spots extending from the hind margin towards the subapex, the lower spots large and contiguous, those from 2–6 decreasing in size and separate. Border of wing immaculate. Hind wing, blue-black, shading to brownish on the inner fold. Disc of wing crossed by a series of contiguous blue spots of increasing size from subcosta towards, but not encroaching on, the inner fold. The submarginal zone with a series of white punctiform spots, triangular or rounded, with blue surrounds, the spots at the upper angle usually strongest, tending to decrease in size toward the anal angle. Margin with very narrow blue line, sometimes interrupted. There is a slight projection at the end vein 4. *Underside.* Fore wing, ground colour pale greyish brown, slightly darker at the base; a darker band crosses the wing, widest at costa passing through the apex of the cell and bases of 4–7, gradually decreasing in width toward the hind margin; the apical portion of wing also dark, more so in the 'bay' of the wing, and this is crossed by a dark line, shaded whitish proximally, almost straight from hind margin to vein 7, where it turns outward to the apex. Cell with two dark spots in sub-base. Hind wing, ground colour slightly paler than fore wing, with a slight indication of a dark band in discal line. The wing is crossed by a strong dark brownish line from the costa to above the anal angle; this line may be almost straight or sinuous, curving slightly at the inner fold. Submargin with a row of white or buffish white spots, strongest at upper angle, fading out toward the hind angle. Margin of wing with slightly darkened border from which faint dark rays extend inward to the white spots.

Female. Fore wing length 43 mm. *Upperside.* Fore wing, ground colour black, costa slightly browner at base. A small elongate blue mark beyond the end of cell and a subcostal streak beyond. The wing is crossed by a series of blue spots extending from the hind margin to the subapex in an almost straight line, thus further from the margin than in the case of the male. Hind wing discal spots blue, forming a band of increasing width from the costa to short of the inner fold. Submarginal blue spots strong in the upper angle but reduced in size and fading out toward the anal angle where the spots are small and double. A well developed though thin tail with rounded end, at end of vein 4. Margin with continuous blue line above and below the tail. *Underside.* Very similar to that of the male, but hind wing paler.

The female neallotype is from the Central African Republic at Bangui, January 1967 (*Minig*), in Coll. Plantrou. Paris.

Range. Cameroun, Central African Republic, Republic of Congo (Kinshasa), Gabon, and North and Central Congo (Brazzaville).

### ***Charaxes porthos katangae*** Rousseau–Decelle

(Pl. 9, figs 114 & 115; Map 6)

*Charaxes porthos katangae* Rousseau-Decelle, 1931 : 87.

Known only from the holotype male. The species was not recorded by Overlaet, 1925, *Explor. du Parc Nat. de l'Upemba*, Fasc. 27.

Male. Fore wing length 40 mm. Shape similar to *porthos dummeri*. *Upperside.* Fore wing, ground colour blue-black, slightly paler on the outer margin, which carries two white spots at the apex. A blue spot beyond the end of the cell with a trace of a minute one above. The series of blue spots crossing the wing from about mid hind margin, is rather sinuous, the two spots in 1b being set in somewhat, those in 2–3 4–5 in a slight curve, the two upper spots small. Hind wing, ground colour blue-black, shading to brownish on the inner fold. The band of contiguous blue spots crosses the disc from just short of the inner fold, through the apex of the cell and represented in the costa by a separate spot. Bluish white spots on submargin strong at the upper angle, fading out below, double at anal angle. Margin with a continuous line of blue, interrupted only by the dark veins. The anal angle is rather pointed. *Underside.* Very similar to the pale form of *porthos dummeri.* Fore wing, the dark line crossing the wing is strong, ending in a whitish area at the apex; dark lines at right angles to this line present on proximal side in 1b and 2. Hind wing, ground colour paler than *dummeri*, the darker zones in sub-base very faint; but the dark line crossing the wing from costa to above the anal angle is strong, and almost straight with an indication of faint whitish loops on the proximal side. Submargin with a series of white dots, strong at upper angle but small and faint to anal angle. Margin of wing slightly brownish.

RANGE. South-eastern Congo (Kinshasa) in the Katanga area.

## ***Charaxes porthos dummeri*** Joicey & Talbot

(Pls 9 & 10, figs 109, 116, 117; Map 6)

*Charaxes porthos dummeri* Joicey & Talbot, 1922 : 338.
*Charaxes porthos dummeri* Joicey & Talbot; van Someren, 1957 : 177.
*Charaxes porthos dummeri* Joicey & Talbot; van Someren, 1968 : 224.

MALE. Fore wing length 37–40 mm. Shape similar to other races, apex rather rounded. *Upperside.* Fore wing, deep blue-black. The blue spot beyond the end of the cell, consisting of a large central spot with smaller ones above and below, unusually large. The series of blue spots crossing the wing from the hind margin to the subapex usually strong and bolder than in nominate *porthos*, widest from 1a–2 and contiguous, diminishing in size and well separated to 6, arranged in a slight curve. Apex of wing with slight indication of pale off-white triangles. Hind wing, ground colour blue-black, duller at costa and dull black on the inner fold. The series of blue spots commencing at the costa increase in size toward the inner fold, that on the fold less strongly blue. Submargin with series of white dots, conspicuous at upper angle, which become small and somewhat obscured below, double at anal angle. Margin with narrow continuous blue line fading out at 6. *Underside.* Fore wing, ground colour ashy brownish grey, but shading to more brownish on the border, especially in the 'bay' of the wing. Obscure dark bands present at the base and in the discal zone and through the mid areas of 4–6, the apex of the wing slightly whitish. The cell with two dots. The blackish brown line strong, crossing from the hind margin to 6 in an almost straight line, bends sharply to the apex. Two obscure pale spots sometimes present at the tornus. Hind wing, ground colour as fore wing, the basal area with faintly indicated darker bands narrowly edged in black. The dark bar strong, crossing from costa to above anal angle accentuated on proximal side with whitish. Submargin with punctiform white spots, most apparent at the upper angle, double at anal angle. Margin of wing slightly browner.

FEMALE. Very like the male, but slightly larger, length of fore wing 42 mm. Hind wing with a longish tail at end of vein 4, 5 mm in length. *Upperside.* Fore wing blue-black, slightly brownish at base and along costa. Pattern of blue spots bolder than in the male, but blue less intense; the line of spots curving gently from 2–5. There are minute spots in the submargin of the tornus. Hind wing more rounded at hind angle than in the male, but tail well developed. Discal blue band crossing the wing wider than in the male, ending more abruptly at the inner fold. Submargin with a row of well developed bluish white spots; margin with a continuous blue line from anal angle to 6. *Underside.* Ground colour very similar to that of the male, the dark bar on the hind wing stronger and broader, and the white spots on the submargin more distinct.

RANGE. Uganda, mainly in the forests around Lake Victoria; north-western Kenya, Kamengo, Katera and Mabira.

## ***Charaxes porthos gallayi*** van Someren

### (Pl. 10, figs 118–121; Map 6)

*Charaxes porthos gallayi* van Someren, 1968 : 223.

MALE. Fore wing length 33–36 mm. Shape similar to that of other races but hind angle of fore wing projecting slightly more at 1b–2, so that the marginal curve toward the apex appears deeper. *Upperside.* Fore wing, pattern of blue spots very similar to that of *porthos dummeri* but the small upper spots of the postdiscal line more extended and curving toward the costa; the spot beyond the end of the cell not so large as in *dummeri*. Hind wing, blue band wider in the mid area at end of cell, the spot at costal end separate. The submarginal white spots are very small, except the two at the upper angle. The anal angle is rather more pointed, and there is a suggestion of a rudimentary 'tail' at end of vein 4. *Underside.* Fore wing differs from the nominate race and also from *dummeri* by the absence of the dark brownish line which separates the basal area from the dark border in the distal curve of the wing. On the hind wing the dark line is also reduced in intensity and is slightly more curved inward than in other races. The submarginal white spots are obscured except those at the upper angle.

FEMALE. Fore wing length, 40 mm. The apex of the wing more falcate, but the tip is 'squared-off'. *Upperside.* Fore wing, there are two blue spots beyond the end of the cell. The blue spots in the postdiscal line are similar to that of the male. Hind wing, blue band is wider toward the inner fold, decreasing in width toward the costa. The submarginal bluish white spots well developed, as also is the blue line on the margin. A strong tail is present at the end of vein 4, 4–5 mm in length, and a rudiment-'tail' on vein 2. *Underside.* Fore wing ground colour and pattern as in the male, with the entire absence of the dark line usually noted in this species. On the hind wing, the dark line is moderately strong and straighter than in the male. The submarginal white dots present, but obscured, except for the two at upper angle. Edge of wing slightly brownish. (N.B. The dark patches at the bases of the wings in the plates are due to stains.)

The holotype male and allotype female, taken on the Ivory Coast at Divo, are deposited in the Paris Museum. Other specimens in Plantrou coll., Paris.

RANGE. Ivory Coast.

## ***Charaxes zelica zelica*** Butler

### (Pls 10 & 11, figs 122–126, 131; Map 6)

*Charaxes zelica zelica* Butler, 1869 : 28.

The distribution of the nominate race appears to be uncertain, as the locality of the type is given as Ashanti with a query. Talbot (1921 : 69) records the typical form as present in Sierra Leone, basing his observations on the male specimen then in the Hill Museum, and now in British Museum. I have before me four male examples from the Ivory Coast, and these, on locality, should be referred to the nominate race.

MALE. Fore wing length 35–36 mm. Shape, apex not unduly produced and tip rounded; outer margin not strongly incised and hind angle not projecting, but hind wing of similar shape to others of the group with rather pointed anal angle. *Upperside.* Fore wing, ground colour blue-black; blue spots limited to a series in the discal line arranged in a gentle curve, commencing with two longitudinal subcostal spots, followed by more vertical spots in 1b–3, that on the hind margin in 1a a streak, set in a little. A single spot in 6 just short of the mid point. Hind wing, ground colour blue-black, with a series of blue spots in an almost straight line commencing at the upper angle and extending to above the anal angle; all spots discrete. Submargin with a series of punctiform or triangular bluish white spots complete; margin with an interrupted series of blue lunules complete or most marked toward the hind angle. *Underside.* Fore wing, ground colour drab greyish brown, with a darker pattern of obscured bands, one at sub-base of fore wing, followed by a bar in the discal line, widest at costa and tapering toward the hind margin; a darker band, wide at the costa, tapering toward the hind margin, accentuates the paler border from apex to hind angle, the junction bordered distally by obscure paler lunules extending from hind angle to apex. A conspicuous double brownish mark in 1b is a characteristic feature. Hind wing, ground colour as fore wing, the basal pattern obscured, but a dark band, widest at the costa then tapering slightly, crosses wing to above the anal angle and distal to this is a pale line, distally shaded in darker brown, strong at the hind angle then fading out toward the upper angle. The submargin is paler and carries a series of punctiform white spots with black distally, double at anal angle; edge of wing narrowly buffish.

FEMALE. Appears to be still unknown.

RANGE. Sierra Leone to Ivory Coast and Ghana.

Specimens from Nigeria and Cameroun and the Central African Republic at Bangui appear to be transitional toward *depuncta* (Pls 10 & 11, figs 125 & 131).

## ***Charaxes zelica*** cline

MALE. The main difference is one of size, the Cameroun insects measuring 39–42 mm in fore wing length. The blue spots on both fore and hind wings are slightly smaller and there is no blue on the margin of the hind wing. The ochreous spot in underside area 2 is small. Associated with these males is a female specimen from Bangui (Plantrou Coll.) which merits description and comparison with the female of *depuncta* of Uganda.

FEMALE. Fore wing length 42 mm. Shape as in the male, but apex less pointed. *Upperside.* Fore wing, ground colour blue-black. Blue spots limited to two spots in 1b and one each in 2 and 3, all small. Hind wing, ground colour as fore wing, the blue spots in the postdiscal line smaller than in *depuncta*, that at costa a pinpoint, the next three larger and more rounded, followed by three linear marks, that above hind angle obscured. Submargin with punctiform white dots complete; edge bluish white to vein 6. *Underside.* Fore wing, pattern of dark zones obscured except for that on postdiscal zone, accentuated distally by the paler border with its obscure pale linear marks. No ochreous mark in space 2. Hind wing, ground colour as fore wing, pattern obscured except for the pale transverse line bordered on either side by darker areas, wider than in *depuncta*. Submargin with obscured pale marks with white dots. Edge of wing pale.

RANGE. Cameroun and Central African Republic? Republic of Congo and western Congo.

## ***Charaxes zelica depuncta*** Joicey & Talbot

(Pl. 11, figs 127–130; Map 6)

*Charaxes zelica depuncta* Joicey & Talbot, 1921 : 69.

This race was based on a male specimen from the Mabira Forest, Uganda, and a photograph of the holotype is given. It will be noted that the specimen is old and very worn and lacks some of the characters given in the description, which was apparently based on other specimens mentioned as from French Congo, Cameroun.

The original description is as follows:—'Distinguished from the typical form by the absence of the blue marginal dots on the hind wing. The inner edge of the distal area of the underside is less curved on the fore wing and almost straight on the hind wing. In cellules 1b & c of the fore wing, is a pale ochreous patch distal to the postdiscal line, and generally a similar patch proximal to the discal line. The submarginal line on the fore wing ends at the apex; in the typical form it ends at vein 8'.

From the photograph of the type, it will be noted that there are blue dots on the (sub)margin of the hind wing upperside and some blue on the edge. The ochreous patches on either side of the discal (dark) band are absent, though present in other specimens; from Uganda, such as is figured on Pl. 11, figs 128 & 129.

As I have pointed out, specimens from Uganda are larger than nominate *zelica*, the fore wing measurements of a series being 39–42 mm in the males. The upperside fore wing blue spots are larger, and those of the hind wing also larger; the marginal blue lunules on the hind wing may be obsolete or limited to those toward the hind angle. The underside ground colour is rather browner and more satiny; the dark bands strong. The ochreous mark in 1b of the fore wing usually well developed.

FEMALE. I described this (1957 : 177) as follows:—'Very similar to the male in coloration but fore wing longer and generally wider, apex more rounded. Length of fore wing 45 mm. The blue spotting is duller and small, expecially those of the hind wing.' Submargin of wing with well marked white spots; admargin only blue in region of hind angle. 'Underside as in the male, but duller and (often) lacking the two ochreous marks in 1b of the fore wing.'

RANGE. Forests in east, central and western districts of Uganda.

### ***Charaxes zelica*** subsp.?

I give a photograph of an interesting specimen from Katanga, taken at Kafakumba, S. Congo, by Dr C. H. McCleery. It is said to be a male, but it bears a very strong resemblance to the female of *zelica depuncta* (Pl. 11, fig. 131) above, but the underside is somewhat different. More specimens are required, before it can be satisfactorily allocated.

### ***Charaxes zelica toyoshimai*** Carcasson

(Pl. 11, fig. 132)

*Charaxes zelica toyoshimai* Carcasson, 1964 : 65; 1966 : 23.

MALE. Fore wing length 39 mm. Shape very similar to depuncta. *Upperside*. Fore wing, ground colour blue-black with a stronger greenish blue basal sheen. Blue spots in fore wing similarly placed but larger. Hind wing, ground colour as in other races but spots larger and more elongate. Spots on the submargin larger and more distinct, as a rule, and mostly blue, except those in 3–4; marginal blue linear marks strong in some specimens, weak or absent in others. The type, which is an exceptionally well marked specimen, was taken in the Mukuyu forest at the north-east end of Lale Tanganyika, and is deposited in the British Museum (Nat. Hist.) *Underside*. Described as being similar to the nominate race but fore wing rather browner, the postdiscal band being particularly strong toward the apex, so that the whitish line on the proximal side of the border is better marked. The pale area has a series of whitish lunules distally shaded in greyish. There are two whitish spots in the sub-base of the cell. Hind wing, the dark band in the disc not well marked but that in the postdiscal zone wide at the costal end and divided by a whitish line, tapers toward the hind angle, accentuated distally by a pale area in lower submargin which carries a series of white dots distally accentuated by black linear marks.

Female. Unknown.

Range. So far only recorded from the north-east end of Lake Tanganyika in the Kigoma district, Tanzania.

## ***Charaxes laodice*** (Drury)

(Pls 11 & 12, figs 133–139; Map 6)

*Papilio Nymphalis Phaleratus laodice* Drury, 1782 : 34.
=*nesiope* Hewitson, 1876 : 3(1), pl. 45.
=*Papilio Nymphalis lycurgus* Fabricius, 1795 : 67.
*Palla laodice* (Drury); Kirby, 1871 : 274.
*Charaxes laodice* (Drury); Aurivillius, 1894 : 312.

Male. Fore wing length somewhat variable; Rothschild gives the length as 33–38 mm. In the series before me the average length is 32 mm, but one specimen from Coquilhatville, mid Congo River, measures 38 mm. The Ivory Coast specimens are all small. Shape of fore wing, costa rather curved, apex falcate, but tip 'squared off', outer margin deeply concave at 4–5, hind angle, produced at vein 2, apex rounded. *Upperside.* Fore wing, ground colour deep blue-black; a blue spot at subcosta beyond the end of the cell; a single blue spot in the sub-apex, followed by spots of increasing size in the submargin from 3 to 1b, the mark in 1a small, or a streak. Hind wing, ground colour as fore wing, paler on the inner fold; disc of wing immaculate but blue band on submargin well developed, the distal edges of the spots almost straight, the inner more irregular as some of the spots are angled, the spot at the upper angle, if present, usually small; admargin of wing with interrupted blue lunules, most pronounced in the mid area. There is a suggestion of a rudimentary tail at end of vein 4. Anal angle produced but apex rounded. The specimen from Coquilhatville is boldly marked on the hind wing, and the spots on the fore wing are bold. *Underside.* Fore wing, ground colour satiny lead-black crossed by darker bands, a short band in the sub-base followed by a stronger band in the discal line; a somewhat triangular dark area, base toward costa, is bordered proximally and distally in paler lead-grey and whitish, the latter extending into the apex of the wing and accentuating the dark colour in the 'bay' of the outer border of the wing. Two black spots, outlined whitish present in sub-base of cell. Within the hind angle is a series of obscured, dyslegnic rufous spots in a half circle, fading out toward the apex. Hind wing, ground colour as fore wing, basal area crossed by a darker brownish black bar, widest at costa and tapering toward the inner fold, this is followed by a less dark band which joins the first. The wing is crossed by a dark brownish black band, widest at the costa and tapering to above the hind angle; this band is enhanced proximally by a pale line and distally by the satiny lead-grey-black border which carries small white dots in the sub-marginal line; edge of wing dark brownish black, often with extensions on proximal side toward the white dots, particularly in the region of the hind angle; extreme edge of anal angle greenish. This description of western examples, is given in some detail for comparison with specimens from Kigoma and Nuba Mts referred to later.

Female. Larger than the male, fore wing length 40–45 mm. Shape very similar, but apex more produced and concavity on outer margin deeper. *Upperside.* Fore wing, ground colour of fore wing duller black, sometimes brownish black. Pattern of blue spots as in the male but submarginal spots toward hind angle smaller and more linear. Hind wing, ground colour as fore wing, duller on inner fold. Border of wing strongly rufescent brown, separated from the black of the disc by a series of blue lunules extending from above the anal angle to 5, and a small spot in 6. Submargin with obscure white dots, double at anal angle where they are distally edged with black. Tail at end of vein 4 well developed, short, robust with rounded end, 5 mm in length. *Underside.* Fore wing, ground colour more brownish than in the male, the pattern more obscured. Hind wing similar, but dark band moderately strong, with distal edge rather irregular due to projections along the veins. Submarginal spots small or obscured; marginal border brownish, this colour extending up the tails.

RANGE. The nominate race ranges from Sierra Leone, Ivory Coast, Ghana, Nigeria, Cameroun. Republic of Congo and Gabon & Congo. Also recorded from Fernando Po.

### **Charaxes laodice** subsp. 1?

(Pl. 12, figs 137–138; Map 6)

Male specimens I have examined from the Kigoma district, north-east of Lake Tanganyika are smaller and average 31–33 mm. The blue spots of the fore wing larger, those beyond the end of the cell usually double. The blue spots on the hind wing less separated by dark veins and the marginal lunules more developed. The outer margin of the fore wing less concave. On the underside the ground colour is darker and the pattern less obvious; the brown of the hind angle more extensive. Hind wing with similar suppression of pattern but dark band strong; the marginal border more rufescent.

Carcasson (1966 : 56) figures a very boldly marked specimen of a male, with two large subcostal blue spots beyond the end of the cell in the fore wing, and the submarginal spots are also large. On the hind wing the submarginal spots are equally large and coalescent at the lower part of the series; the marginal lunules also very large, that in 6 conjoined to the submarginal spot in the same area.

A very similar insect is found in the Bwamba Valley in western Uganda.

### **Charaxes laodice** subsp. 2?

(Pl. 12, figs 137–138; Map 6)

I have also examined an interesting male specimen from the Nuba Mountains, south-west of El Obeid, Sudan (Pl. 12, fig. 139), which also had bold blue spotting in the fore wing, where the submarginal series extends to 6. The hind wing submarginal spots and those on the admargin are equally bold. The underside is very dark, the pattern obscured. The border of the hind wing is chestnut.

More specimens are required before this insect can be placed satisfactorily.

### **Charaxes dunkeli** Röber

(Pl. 12, fig. 140; Map 6)

*Charaxes dunkeli* Röber, 1939 : 357. Type locality, Cameroun.

This very distinct species belongs to the *Ch. mycerina-porthos* complex but presents some distinctive features both above and below. It appears to be very rare in collections. I am indebted to Monsieur Jacques Plantrou for photographs of a specimen in his collection.

I quote a translation of the original description: 'Comes closest to *porthos* Smith, from the Cameroons, . . . and *katangae* Rousseau-Decelle. Above, the outline (shape) of the wings is almost identical, but the indentation on the outer margin of the fore wing is more distinct. The band of blue spots on the fore wing has no greenish tinge, and consists of three larger spots between the inner margin and the second branch of the median vein, separated only by black veins, and the posterior radial vein. There is no similar spot at the end of the median cell. The blue median band of the hind wing is more narrow and cut off in an almost straight line at both ends. The bluish-white submarginal dots are more distinct. The underside surfaces of both wings resembles that of *porthos* but shows enough differences . . . that *dunkeli* can be considered as specifically distinct. The brown submarginal band of the front wing is lacking, but the markings on the proximal parts of the wing are very distinct, the median band consisting of seven crescentic-shaped spots, each about 1 mm broad and terminating in white on both sides. At the end of the marginal cell there is a large bluish-greenish-blackish speckled spot and between this and the base of the wing can be seen a large black spot of the same width as the median cell. Proximal to this there are two small confluent spots surrounded by bluish grey. The distal continuation of the big black spot is made up of two black spots surrounded by greyish-blue. The colour of the hind wing is lighter, much the same as the front wing but with more of a silky sheen, and the dark median band is less jagged. Type male, wing spread 65 mm. Named after its discoverer G. Dunkel.'

The specimen in the Plantrou collection differs only in minor details; the fore wing blue bar is extended into cellule 3, where there is a slight blue streak; the hind wing band is also extended toward the costa. There is a rudimentary 'tail' at the end of vein 4.

DISTRIBUTION. Known only from the Cameroun.

## SYSTEMATIC LIST

### ***Charaxes mycerina*** **Godart**

*Charaxes mycerina* Godart, 1824. Type locality: Sierra Leone?
Range: Sierra Leone, Ghana, Nigeria, Cameroun, Fernando Po, Congo (Kinshasa) including Kasai, Gabon, Central African Republic, Republic of Congo.

### ***Charaxes doubledayi*** **Aurivillius**

*Charaxes doubledayi* Aurivillius, 1899. Type locality: Sierra Leone.
Range: Sierra Leone, Togo, Nigeria, Cameroun, Gabon, Central African Republic, Republic of Congo (Kinshasa), Congo (Brazzaville).

### ***Charaxes porthos*** **Grose Smith**

*Charaxes porthos porthos* Grose Smith, 1883. Type locality: Cameroun.
Range: Cameroun, Central African Republic, Republic of Congo (Kinshasa), Congo (Gabon, Brazzaville) excluding Katanga.

*porthos katangae* Rousseau-Decelle, 1931. Type locality: Katanga.
Range: Southern Congo (Kinshasa), Katanga district.
*porthos dummeri* Joicey & Talbot, 1922. Type locality: Uganda, Mabira Forest.
Range: Uganda generally, and north-west Kenya.
*porthos gallayi* van Someren, 1968. Type locality: Ivory Coast.
Range: Ivory Coast.

### ***Charaxes zelica*** Butler

*Charaxes zelica zelica* Butler, 1869. Type locality: Ashanti.
Range: Sierra Leone, Nigeria, Cameroun, Gabon, N. Angola.
*zelica depuncta* Joicey & Talbot, 1921. Type locality: Uganda.
Range: Uganda, Congo (Kinshasa), Katanga, Central African Republic, southern Sudan.
*zelica toyoshimai* Carcasson, 1964. Type locality: Tanzania, Kigoma district, north-east Lake Tanganyika.
Range: Only known from type locality.

### ***Charaxes laodice*** (Drury)

*Charaxes laodice* Drury, 1782. Type locality: Sierra Leone.
Range: Sierra Leone, Ivory Coast, Ghana, Nigeria, Cameroun, Fernando Po, Gabon, Central African Republic, Republic of Congo, northern Angola, Congo including Katanga.
*laodice* subsp. 1?
Range: Tanzania, Kigoma district north-east Lake Tanganyika, Uganda in the Semliki and Bwamba Valleys.
*laodice* subsp. 2?
Range: Sudan, Nuba Mts.

### ***Charaxes dunkeli*** Röber

*Charaxes dunkeli* Röber, 1939. Type locality: Cameroun.
Range: Cameroun.

## 7. ***CHARAXES NICHETES*** GROSE-SMITH AND ITS SUBSPECIES

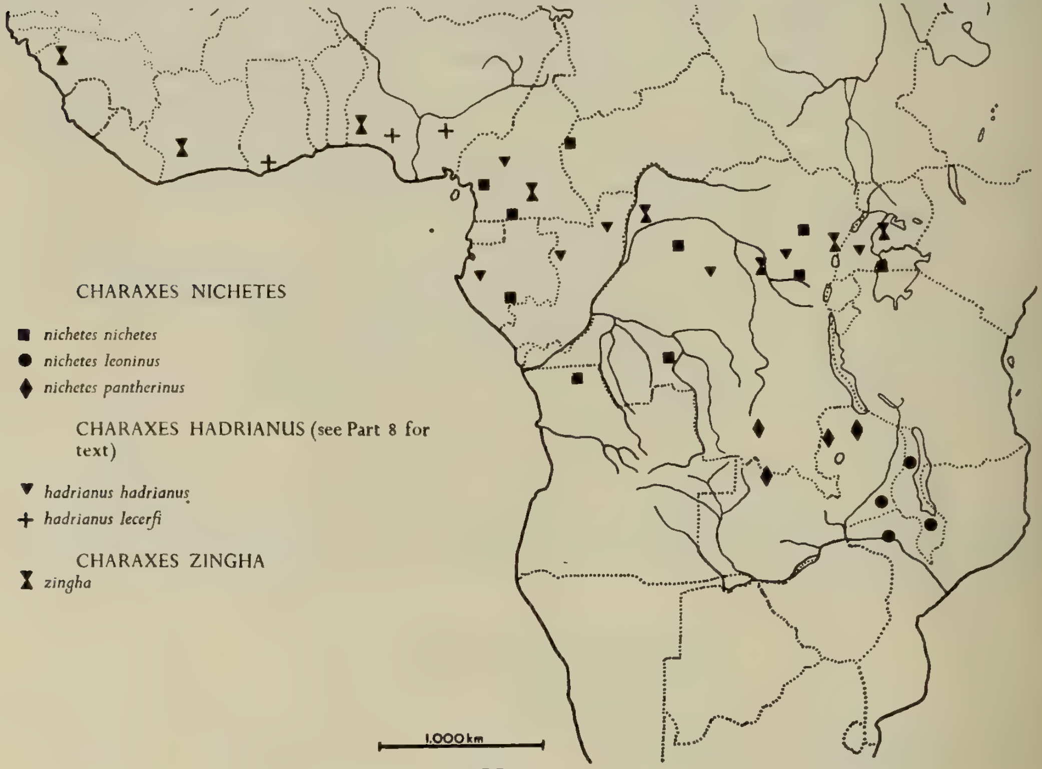
We come now to an outlying member of this 'group', which has a different biotope: valley-forest, woodlands and heavy savannah; the dominant colours are tawny rufous and black.

### ***Charaxes nichetes nichetes*** Grose-Smith

(Pl. 12, figs 141–144; Map 7)

*Charaxes nichetes nichetes* Grose-Smith, 1883 : 50.
*Charaxes hamatus* Dewitz, 1884 : 285.
*Charaxes ogovensis* Holland, 1886 : 330.

Male. Fore wing length 35–38 mm. Shape, costa curved toward apex, apex produced, tip rounded, outer margin concave from 3 to 5, hind angle produced at 1b but angle squared. *Upperside.* Fore wing, basal area orange-chestnut, with a strong purplish tint in side-light, the rufescent colour shading to black beyond, the black sharply defined from the rufous-orange border. The pattern consists of a small black spot in upper part of mid cell and a larger one at its end; in the discal line are two large rounded black spots in sub-bases of 5–6 and similar spots in sub-bases of 3 & 2, the two upper spots at an angle to the blacker series of conjoined angled marks of the postdiscal line, which runs from the costa to the hind margin, the upper spots of these two rows separated by an orange mark; the outer ends of these angled marks have extensions along the veins, which tend to separate the submarginal series of paler rufous-orange spots, which extend from the costa to the hind margin in increasing size, the marks in 4–6 uniform in size. The apex is rufous tawny; the marginal border of the wing, especially in the 'bay' is blackish. Hind wing, basal area black with a large tawny-orange patch at the costa, thus dividing the base of the black triangle, which tapers rapidly toward the hind angle. The inner fold is buffish at its basal half, but more rufous at its end. The black area is sinuate on its outer edge, with rays which tend to separate the postdiscal series of rufous-orange spots, especially in the mid area, of which the upper spots are of about equal width but those below the apex of the cell decrease in size to the hind angle. Beyond is a submarginal row of blackish spots with tawny orange enclosed spots, the black spots may be rounded and separate in the upper segment or conjoined. The border of the wing is tawny orange with the extreme edge darker with slight white fringe in the region of the slight projections of the lower veins. *Underside.* Basal portion of fore and hind wing, up to the dark transverse line rufescent greyish with a slight purplish tinge. Within the dark areas are darker rufous rather obscure 'ring' marks with large centres in the discal line and beyond in the subcostal region. On the line



Map 7.

of junction between the basal area and the more rufescent border of the wings is a zigzag line of contiguous triangles, accentuated in greyish, the mark on the apex is whitish. The border of the wing is more rufescent, the edge being darker chestnut-brown. On the hind wing there is a series of small whitish or lilac spots accentuated distally with black, double at the anal angle. The border of the wing is rufescent.

FEMALE. Larger than the male, fore wing length 42–44 mm. The apex is more extended than in the male. *Upperside.* Fore wing, general colour and pattern like that of the male, but markings larger, the discal and postdiscal black spots tending to merge, but the submarginal tawny-orange spots are more discrete. Hind wing, the tawny-orange band is more restricted on the distal side by an increase in the width of the dark area beyond, but in some specimens the series of pale marks on its distal side are conspicuous; the marginal border is tawny-orange. Many specimens exhibit a distinct rudimentary tail at the end of vein 4. *Underside.* Very similar to that of the male but rather paler, especially on the outer border of both wings. The dark markings are slightly more apparent, especially the dark line which runs through both wings, commencing more proximad at the apex and is curved in 1a–1b of the fore wing.

The foregoing descriptions are taken from specimens from Coquihatville, Congo and from Bugalla Is of the Sesse group in Lake Victoria, Uganda. It will be seen from Pl. 12, figs 143–144 that the latter specimens are more boldly marked.

RANGE. Cameroun, Central African Republic and Republic of Congo, Gabon and northern Angola and the Kasai district and northern Congo, eastward to Lake Victoria in Uganda, where the species has been taken on the Sesse Islands and in the lake-forests of Entebbe. There are no records from western Uganda that I know of.

### ***Charaxes nichetes leoninus*** Butler

(Pls 12 & 13, figs 145–147; Map 7)

*Charaxes nichetes leoninus* Butler, 1895 : 255.

MALE. Fore wing length, 38–40 mm. Shape similar to the nominate race. *Upperside.* Fore wing coloration much paler, more tawny orange, but still retains the purplish sheen, and the pattern of dark marks greatly reduced and not so black. Hind wing, the dark discal line is not extended basad. The underside coloration is also paler and the dark cross line is almost obsolete.

FEMALE. *Upperside.* Fore wing, the ground colour is also paler but the pattern of dark marks, though reduced, stands out more clearly. Hind wing, the series of dark spots with pale centres gives greater character to this zone. *Underside.* Ground colour is considerably paler than in the nominate race and the transverse dark line is thinner.

RANGE. Malawi and adjacent Zambia, particularly east of the Loangwe Valley. There is some evidence of intergrading between this race and *pantherinus* of the Katanga area of southern Congo (Kinshasa), on the borders between the two countries.

### ***Charaxes nichetes pantherinus*** Rousseau-Decelle

(Pl. 13, fig. 148; Map 7)

*Charaxes nichetes pantherinus* Rousseau-Decelle, 1934 : 234.

MALE. Fore wing length, 34–37 mm. *Upperside.* General coloration and pattern nearer to *leonina* than to the nominate race. Fore wing, ground colour bright orange rufous; black spots on proximal side of postdiscal line well separated, though variable in size; postdiscal dark bar serrate on borders, extending from hind border to subapex; submarginal dark spots complete. Hind wing, ground colour as fore wing; dark bar continuous with that of fore wing but fading out on inner fold. Submarginal row of dark rings complete from upper angle to anal projection. *Underside.* Fore wing dull rufous in ground colour, with obscure dark spots in basal area; postdiscal crossed by a narrow, almost straight dark line, extending from subapex to anal angle, bordered distally by a satiny zone margined distally by a rufous line; border of wings satiny, but edge rufous.

FEMALE. Fore wing length 40 mm. Shape similar to that of male. *Upperside.* Ground colour paler, more yellowish. Pattern similar to that of male but more distinct and bolder. *Underside.* Paler and duller than in the male but basal marks and postdiscal in an almost straight line crossing both wings, more distinct.

RANGE. South-east Congo (Kinshasa), in the Katanga Province at Kafakumba, extending into the Kigoma area and in north-west Zambia.

### ***Charaxes zingha*** (Stoll)

### (Pl. 13, figs 149–151; Map 7)

*Papilio Nymphalis Phaleratus zingha* Stoll, *in* Cramer, 1780, 53, T. 315.
*Papilio phaleratus berenice* Drury, 1872 : (3) 13.

MALE. Fore wing length 34–38 mm. Shape of fore wing, apex rather rounded, as also the hind angle, and outer margin almost straight. Hind wing outer margin rounded, but anal angle produced as a stumpy tail with an outward curve, the margin above tail slightly dentate. *Upperside.* Fore wing, ground colour black, base of costa rufous; base and disc of wing with a large reddish orange area filling the base of the cell, slightly more than the basal half of 1a & 1b, gradually tapering to 4, with two smaller spots in 5, sometimes with a trace of a spot in 6, the two upper spots more orange. There is often a trace of a dark spot at the base of the cell, two black spots at mid-point and a black spot sub-basal in 3. The outer margin of the orange-red area 'toothed' in 3–4. In some specimens the orange-red encroaches into the black of the mid subcostal area. Hind wing mostly black, with a reddish orange basal triangle with slight extension along the costa in 6. Inner fold brownish at base, shading to black on distal half. Border of wing thus broadly black but with conspicuous small orange-red spots in 3–2, continued as white spots at anal angle and on the inner fold; the angle with two larger conspicuous orange spots. The admargin with larger reddish orange spots increasing in size from 3–6; edge of wing black with slight white fringe in region of tail. *Underside.* In contrast to the simple pattern above, the lower surface presents a complicated pattern of black spots and lines. Fore wing, basal portion ochreous-pink to ochre-red, the distal portion, from upper part of cell to apex and cellule 3, pinkish grey, paler on hind border. The cell carries conspicuous rounded black spots, one at base of costa, one at base of cell, two in sub-base, two or three in subapex, free, or often conjoined, followed by a black bar at end of cell and bases of cellules beyond; there is a less strong bar in discal line in cellules 5–7, with larger bold black spots in sub-bases of 2–3; and in the postdiscal line, a similar greyish bar crossing cellules 3–7, with stronger, blacker star-mark in 2. The pale greyish apical half of the wing is rayed with black along the veins and middle of cellules, running parallel to each other from the end of the cell to the margin. The submarginal zone has obscure dark spots, becoming clearer and larger in 2 to the hind margin, that at the margin, a long streak. Edge of wing greyish black. Hind wing, basal costal area pinkish to pinkish white, the costal cellule with three large rounded black spots and two at the base; cellule 7 with two rounded black spots; base of wing and along the inner margin black, the basal area with four rows of angular white spots to apex of cell, then follows a series of elongate silvery white marks on the inner fold and bases of 1a–1c, the bars becoming inverted loops in 3–4, then represented by inverted angles shaded with crimson from 5 to subcosta; this row is succeeded by a parallel series of somewhat similar marks, whitish on the inner margin, then greyer, shaded with crimson, while on the submargin the marks are smaller, more quadrate and greyish, but those above the anal angle are larger, orange or orange-white, with a white triangular mark on the inner fold. The marginal border is maroon, breaking up into small silvery white spots above the anal angle where there is a large golden mark on the proximal side of the tail, which is black. Edge of wing black at hind angle, browner above.

FEMALE. Larger than the male, but shape similar; for wing length 45–47 mm. *Upperside.* Pattern very like that of male but paler reddish orange, though darker where it extends more into the cell and also encroaches more on the distal side, the edge being rounder; the black spots in and about the cell more obvious Hind wing very similar to that of the male, but the white and orange spotting in the hind angle and around the anal angle, larger and more conspicuous. The marginal border is broader and redder.

For life history, *vide* van Someren, 1936.

RANGE. Except that extreme western examples tend to be small, there is little difference in colour and pattern throughout the range, which extends from Sierra Leone, Liberia, Ivory Coast to Angola; Cameroun, Central Africa Republic, Republic of the Congo (Kinshasa), northern Angola eastward to Uganda. Apparently not recorded from Katanga.

### SYSTEMATIC LIST

### **Charaxes nichetes** Grose-Smith

*Charaxes nichetes nichetes* Grose-Smith, 1883. Type locality: Cameroun.
Range: Cameroun, Central African Republic, Republic of Congo, Gabon, northern Angola, Kasai district, northern Congo (Kinshasa), Uganda, on Sesse Is, Lake Victoria.

*nichetes leoninus* Butler, 1895. Type locality: Zomba, Malawi.
Range: Malawi, Zambia, particularly east of Loangwe Valley.

*nichetes pantherinus* Rousseau-Decelle, 1954. Type locality: Kafakumba area, Katanga.
Range: south-east Congo (Kinshasa), Katanga.

### **Charaxes zingha** (Stoll)

*Charaxes zingha* Stoll, 1780. Type locality: 'Africa' restricted to Sierra Leone.
Range: Sierra Leone, Liberia, Ivory Coast to Angola, Cameroun, Central African Republic, Republic of Congo (Kinshasa), northern Angola eastwards to Uganda.

## 8. THE ***CHARAXES CANDIOPE*** COMPLEX, WITH ALLIED SPECIES AND THOSE CONFINED TO MADAGASCAR

### **Charaxes candiope** (Godart)

(Pls 13 & 14, figs 152–157; Map 8)

*Nymphalis candiope* Godart, 1824 : 353.
*Charaxes viridicostatus* Aurivillius, 1879 : 41.

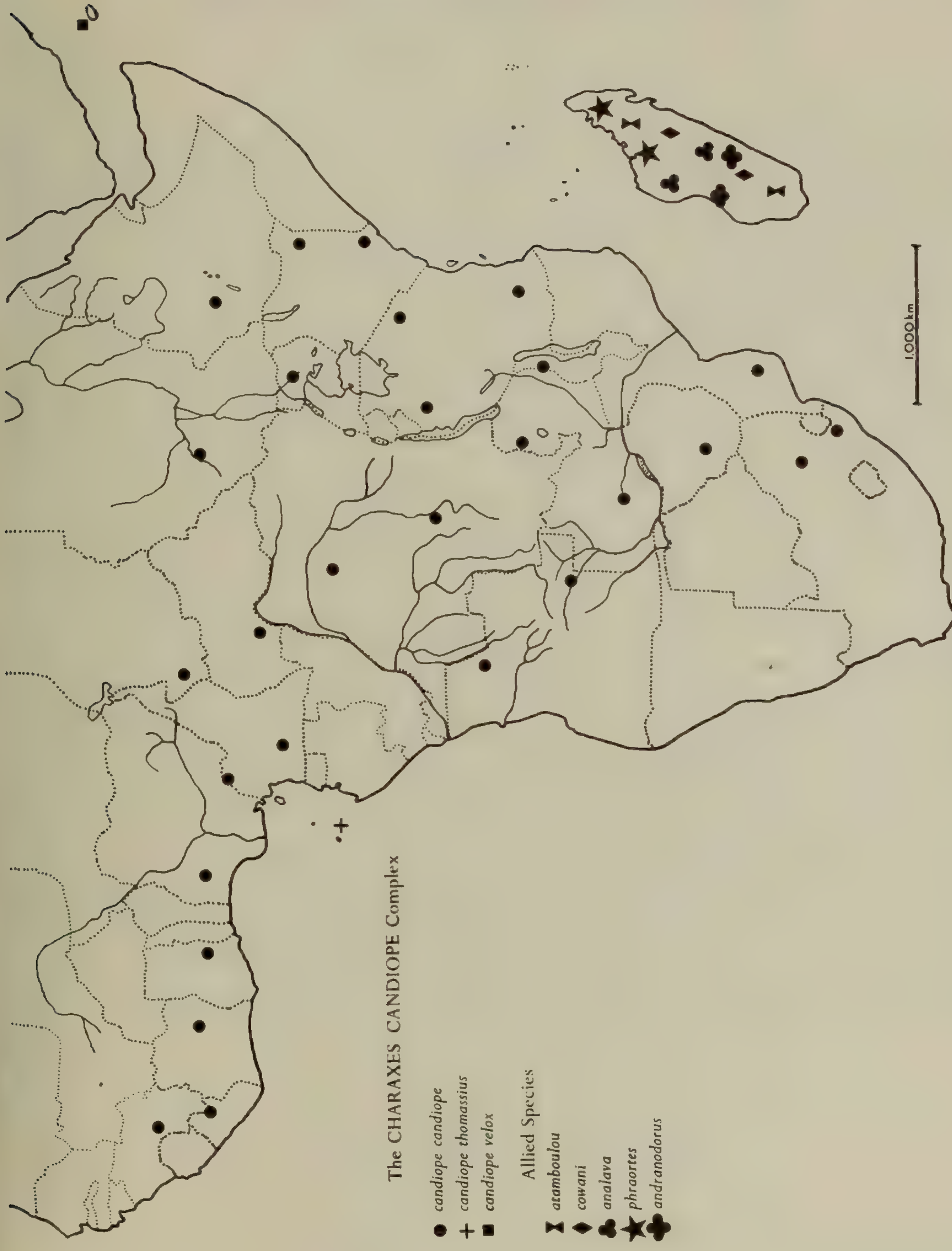
Male. Fore wing length 39–44 mm. Shape, apex bluntly pointed, outer margin gradually concave from 2–4, hind angle slightly projecting at 2; hind wing rounded at upper angle, but tapering to hind angle, with prominent anal angle; margin slightly dentate, with short tail at end of vein 4 and a long tail of vein 2, fused with the upper part of anal angle. *Upperside.* Fore wing, ground colour basal triangle ochre to ochre-yellow with a tinge of green at base accentuated by the green veins, especially that of the costa, shading to rufous-orange in discal zone; border beyond brownish black. Black bar at end of cell and adjacent bases of 5–6 and a small black spot at 3 and obscured black lines below in 2, faint markings present in sub-base and in cell showing through from underside; contiguous triangular black spots in sub-bases 5–6, sometimes joined by a black projection of the border in 4; the junction of the orange and black of border more or less uniform in width, the orange tapering toward the hind margin. The black border with bold orange spots in the postdiscal line, small and rounded at the costal end, gradually increasing in size to 1b, the mark in 1a, if present, a mere streak. Margin of wing with orange-tawny lunules from apex to hind angle, double in 1b. Hind wing, base of costal area greenish, shading distally to yellowish, rather sharply defined from the rufous orange at costa, the ground colour gradually shading rufous, paler on the inner fold; border of wing black, widest at upper angle, then tapering rapidly to region of tails, with a series of tawny orange spots, largest at upper angle, diminishing in size to lower tail; border with large tawny orange lunules darkening toward tails; the anal angle with olive ground outlined proximally in lilac and with two black spots. Upper tail short, sharply pointed, 2–4 mm, lower tail 8 mm, spatulate at end and upcurved. *Underside.* Fore wing, basal triangle pale creamy to ochreous, veins greenish, especially the costa, which has fine white transverse lines. Black lines in the cell clearly marked; brownish area beyond the cell crossed by black lines in sub-bases 6–3, and double line in sub-base 2. A dark brownish bar from costa to 1b separates the basal area from the paler earth-brown border, and is distally ordered in black, most pronounced in 1b & 2, setting off the ocelli in the postdiscal zone, which are obscure and divided in the costal area by a dark mark, but very pronounced in 1b and 2 where they are ochreous and off-set by black distally; the margin carries obscure pale spots, ochreous in colour in 1b, offset by dark edges.

The strength of the pattern is however variable. Hind wing even more variable. The basal costal area is greenish, shading to brownish over the cell and upper portion of the inner fold, the lower more ochreous brownish. The distal side of the basal green area is bordered by a strong dark brownish irregular bar, which runs through the sub-bases of 2 and 3, 4–6 and the cell (which retains a distinct white spot), offsetting an equally irregular creamy ochreous bar on its distal side, which extends from the costa to the end of the cell, then in diminishing irregularity to the inner fold. On the distal side of this pale bar is a series of large blackish lunules, outlined in pinkish white proximally, extending from the costa, in diminishing size, to the anal angle. The border of the wing is earthy brown with a series of ochreous spots in the submarginal line, most apparent at the upper angle, while the admargin carries a series of olive lunules with pale ochreous distally, ending in the olive of the anal angle with the usual twin black bpots. Edge of wing rufescent and extending onto the tails.

Female. Larger than the male, fore wing length 45–55 mm. Shape very similar to male, but hind wing less attenuated, due to presence of a more developed tail on vein 4. *Upperside* ground colour and pattern very like that of male but usually slightly paler in ground colour and pattern bolder. Tails more developed, especially the upper, which may be equal in length to the lower, 12 mm, and more spatulate at ends. *Underside.* Highly variable, ranging from strongly patterned to a form in which the pattern is almost obliterated, especially on the hind wing.

For full account of life history, *vide* van Someren, 1928. The principal food plants are various species of *Croton* (Euphorbiaceae).

Range. Most of tropical Africa and extending to South Africa, but not apparently in the Cape Colony.


The CHARAXES CANDIOPE Complex
● candiope candiope
+ candiope thomassius
■ candiope velox
Allied Species
⧗ atamboulou
◆ cowani
♣ analava
★ phraortes
✚ andranodorus
1,000 km

MAP 8.

## ***Charaxes candiope thomasius*** Staudinger & Schatz

(Pl. 14, fig. 158; Map 8)

*Charaxes candiope thomasius* Staudinger & Schatz, 1886 : 169.

MALE. Fore wing length 46–47 mm. Shape very falcate, outer margin strongly incised at 2–5, but apex blunt and 'squared-off'. *Upperside.* Fore wing, coloration, basal triangle of wing creamy ochreous, shading to more rufescent at line of junction at 1a–2, remainder of wing brownish black. Cell with a small blackish dot in subcosta at mid cell, from which there is a faint dark crescentic mark crossing the cell and a faint line present at end of cell showing through wing from underside. Veins greenish. Within the dark area of the wing there is a fairly distinct creamy spot beyond the end of the cell at the base of 5, and a more obscure series of rufous spots in the postdiscal line; admargin with even more obscure rufous marks in 1b–2. Extreme edge with white internervular fringe. Hind wing, basal area greenish creamy in costal area, shading to more rufescent over cell and towards the inner fold where it becomes greyish, the whole merging into the brownish-black border, the line of junction clear-cut in the subcostal region, where there is a creamy bar in the upper discal line, and here, the pale area is rayed. The black border is immaculate, except for a series of obscure rufous marks in the submarginal line. The admargin also has obscure rufous marks, most apparent at the upper angle. Margin of wing bluntly dentate with long tails on 4 and 2, 8 and 11 mm, spatulate at ends. *Underside.* Fore wing, base of wing more or less as upperside but dark lines in the cell distinct. Ground colour of distal portion of wing earthy brown crossed by a darker brown bar in the postdiscal line, extending from the costa to hind margin, where it tapers. A narrower dark line present in the submargin running from the costa to the hind angle, these two bars obscurely connected by dark rays from the outer edge of the postdiscal bar; the border has indistinct dark rays and a pale mark at the hind angle. Hind wing ground colour as fore wing, but the basal area darker, with a few whitish zigzag lines, bordered in the costal area by a creamy bar extending from costa to upper part of cell, then continued as disjointed whitish marks to cross the inner fold; the postdiscal zone has a brown sinuous bar crossing from the costa to above the anal angle; the submargin has a series of obscure whitish marks distally bordered by dark lunules with dark dots outwardly, double at the anal angle, where the ground colour is slightly olive; the admargin slightly brownish, the tails edged with dark brown.

FEMALE. Larger than the male, fore wing length 50 mm. Shape similar. *Upperside.* Fore wing coloration almost identical, but spots beyond the cell more developed, as also the rufous spots in the postdiscal line. Hind wing, basal pale area more limited, more suffused with smoky grey-brown in lower triangle toward the inner fold; submarginal spots more distinct. *Underside.* Coloration and pattern as in the male, but pattern bolder.

RANGE. Confined to the island of São Thomé in the Gulf of Guinea.

## ***Charaxes candiope velox*** Grant

(Pl. 24, figs 159 & 160; Map 8)

*Charaxes candiope velox* Grant, 1899 : 10.

MALE. Fore wing length 39–41 mm. Shape of fore wing very similar to nominate race, but hind wing less attenuated toward anal angle because of the well developed upper tail at vein 4. *Upperside.* Fore wing, general scheme of coloration and pattern very similar to nominate *candiope*, but ground colour considerably darker, more rufescent, the basal area with only a slight greenish tinge; the dark marks beyond the cell strong; the tawny orange spots in the black border larger and more distinct. Hind wing, the basal area is strongly rufescent, with only a slight pale area at the costa in discal line; the black border mainly limited to the upper angle, tapering rapidly to the upper tail; the submarginal tawny orange spots distinct but diminishing in size to between tails, represented at the anal angle by two black dots on an olive ground, the spots edged proximally with lilac and white. The marginal rufous lunules distinct above upper tail, shading to olive between the tails; tails long and thin, upper 9 mm in length, lower 10 mm. *Underside.* Fore wing, pattern essentially similar to that of nominate race, but ground colour, especially at base, duller greyish ochre, the lines in the cell stronger. The same comments apply to the hind wing where the basal area is generally darker; the postdiscal lunules more defined as also the submarginal pale marks which are buffish.

FEMALE. Larger than the male, fore wing length 43 mm. Shape as in the male, but apex of fore wing slightly more rounded. Ground colour rufescent as in the male but paler; pattern essentially similar but larger and paler, especially those in the submargin of the hind wing, which are almost buffish white. The underside is similar to that of the male.

RANGE. So far recorded only from the island of Sokotra, in the Gulf of Aden.

## ***Charaxes cowani*** Butler

(Pl. 15, figs 161–164; Map 8)

*Charaxes cowani* Butler, 1878 : 285.

MALE. Fore wing length 40–43 mm. Shape less falcate than *candiope* or *antamboulou*, outer margin less incised and thus straighter, and hind wing less prolonged toward anal angle, but outer margin strongly serrate and with long tails. *Upperside.* Fore wing, general coloration darker and richer than *candiope*, the basal area rufescent orange and rather restricted, the line of junction with the distal black border almost straight from just beyond the cell to the hind margin, the enclosed spots in the submarginal line strongly rufous orange; the spots beyond the cell less distinct and limited to one or two in 6–5 with indications of spots in 4–3. Hind wings, rufous orange area in base well defined from the black border at costal end, but less defined toward the inner fold where it is shaded with rufescent brown. The submarginal line of spots, generally reduced in size, extends from the costa to the hind angle, which is olive with two violet-blue spots accentuated distally in black. Margin strongly rufous. Margin serrate, tails long and thin, upper 8 mm, lower 10–11 mm. There is some variation in the size and distinctness of the orange spots on the upperside. *Underside.* Fore wing ground colour richer than in *antamboulou*, the basal area more rufescent; the black cross lines in the cell and sub-bases of 5–3 stronger; the dark discal zone with more obscured pale bars beyond the cell; the paler postdiscal row of spots distally edged with blackish lunules, less clear. The margin bluntly dentate. Hind wing, ground colour with a distinct purplish brown sheen; the discal pale bar less strong at costal end and fading out at end of cell; postdiscal dark line strong, accentuated with black and white lunules at costal end. Submarginal series of lilac lunules on an olive ground, accentuated with black and blue dots distally, strong in the region of tails; edge of wing rufous, strongly serrate with narrow white internervular fringe. The underside colour variable.

FEMALE. Larger than the male, fore wing length 47 mm. *Upperside.* Ground colour and pattern very similar to that of the male, but orange spots larger and bolder on both wings. Tails longer, upper tail 12 mm, lower 8 mm. *Underside.* Pattern and general coloration similar to that of the male, but bolder. It exhibits the same degree of variation.

RANGE. Madagascar.

## ***Charaxes antamboulou*** Lucas

(Pl. 15, figs 165–168; Map 8)

*Charaxes antamboulou* Lucas, 1872 : n. 2.

This insect is closely related to *Ch. candiope* and might well be considered a race.

Male. Fore wing length 40–45 mm. Shape very similar to *Charaxes candiope*, apex bluntly pointed; margin of wing bluntly dentate. *Upperside*. Fore wing, general colour and pattern very similar to *candiope* but more in contrast, the basal area richer orange-ochreous, more sharply defined from the blacker distal portion of the wing, the enclosed spots paler, less rufescent and showing up clearly; the margin of the wing with reduced rufous spots. Veins at base of wing greenish. Hind wing basal area much as in *candiope* but its outer border less rufescent and more sharply defined from the blacker border, where the submarginal spots are smaller or even obsolete; the marginal border narrower; margin more dentate, tails longer and thinner, upper 7–8 mm, lower 10 mm. *Underside*. Fore wing, general colour and pattern very similar to that of *candiope*, but stronger and in more contrast; the basal pale area more defined from the darker distal portion of the wing; the discal pale spots clearer, so also the submarginal pale spots accentuated by the darker line of admarginal marks. Hind wing, ground colour generally darker but the pale marks at sub-base and in discal line, more in contrast; the postdiscal sinuous dark line stronger, as also the pale lunules in the submarginal row. The pattern is however rather variable.

Female. Larger than the male, fore wing length 44–47 mm. *Upperside*. General colour and pattern similar to the male and differing from *candiope* in a similar manner. Fore wing, the basal area is paler, more creamy ochreous, the line of junction dark, almost black, of the distal portion of the wing, strongly demarcated. The dark area embracing the area beyond the cell, so that the two pale spots beyond are reduced in size but are distinct; the postdiscal row of spots paler and in strong contrast; the margin of the wing with reduced lunules. Hind wing colour and pattern as in the male. *Underside*. Somewhat variable, generally darker in ground colour, but pattern in stronger contrast.

Range. Limited to Madagascar.

## ***Charaxes analava*** Ward

(Pl. 16, figs 169 & 170; Map 8)

*Charaxes analava* Ward, 1872 : 3.

Male. Fore wing length 43–45 mm. Fore wing shape, costa rather curved, apex rather falcate but bluntly pointed; outer margin incised and bluntly dentate; hind angle projecting slightly at 1b. *Upperside*. Fore wing, basal triangle creamy ochreous shaded with greenish toward base, extends from just short of the cell end to within 8–10 mm of the hind angle, is sharply defined from the blackish distal portion of the wing, the line of junction irregular. An orange-ochreous rounded or oval spot present in sub-base 6, sometimes with a smaller spot below in 5; postdiscal spots, paler creamy ochre, rounded and distinct, though the spots in 4 and 5 may be small. Margin of wing with small pale internervular marks between the denticules. Hind wing, mostly creamy ochreous sharply defined from the black border which is widest at the upper angle, then tapers to 4 at upper tail. There may be an intrusion of the black into area 3. The margin of the wing is strongly serrate at end of veins, with strongly developed tails at ends of veins 2, 3, 4, upper tail 10 mm, mid tail 5 mm, lower tail 8 mm. Admargin with a line of blackish lunules margined with ochreous proximally, with some darker shading internally. Margin of anal angle with two black spots. *Underside*. Fore wing, with a strongly 'marbled' pattern. Cell dark brown, crossed by a silvery white line with bifid costal end just short of mid point, followed by a broader silvery bar, outlined in black towards its end, with an extension into the sub-base of 3 and base of 4, which are tinged with brownish. These bars are contiguous with the pale area on the hind margin of the wing, which is creamy. The disc of the wing is dark brownish, widest at the costa, with irregular sides, tapering towards, but only just reaching, the hind margin short of the hind angle. There is a whitish line edged distally in black, crossing 5 and 6 below the costa. On the distal border of this dark area are whitish lunules, on the distal side of which are obscure ocelli with dark central dots, largest in the subapex but diminishing in size toward the hind margin. The marginal border of the wing is greyish brown with a narrow white fringe in the interspaces. The hind wing presents an even more complicated pattern. The base of the wing is dark brownish, more or less parallel-sided in its upper portion, but tapering and divided into two at the inner fold, the outer arm angled and crossing 1b and reaches the inner fold. Beyond, the discal zone is greyish brown, sinuous in outline, extending from the costa to above the anal angle. This band in turn is followed by a dark brown bar, narrow at its costal end, widening abruptly at the end of cell, then tapering toward the anal angle. This dark bar is strongly accentuated by silvery white outwardly. The postdiscal zone is brownish grey, paler opposite the tails, with a series of indistinct ocelli, double at the anal angle, greyish in colour, freckled in black and outlined in pale ochre, the ocellus at the upper angle at costa large and conspicuous with black centre. The submargin carries a series of lunules, dull ochreous in colour and accented distally in black, which extends up the serrations and the tails; edge with narrow white fringe in interspaces.

FEMALE. Larger than the male, fore wing length 50 mm. Margins of both wings as dentate and serrate as in the male. *Upperside.* General coloration and pattern as in the male, but the fore wing creamy spots larger; on the hind wing, the two postdiscal dark spots are more defined and larger. *Underside.* Similar to that of the male though bolder, on a paler ground colour.

RANGE. Madagascar.

## ***Charaxes phraortes*** Doubleday

(Pl. 16, figs 171 & 172; Map 8)

*Charaxes phraortes* Doubleday, 1847*a* : 65; 1847*b* : 60.

The male of this distinct species bears a superficial resemblance to the male of *Charaxes andranodorus*, the pattern being very similar, but the orange ground colour is paler. The undersides are, however, quite different.

MALE. Fore wing length 45 mm. Fore wing, apex bluntly pointed, outer margin only slightly incurved at 2–4; hind angle rounded. *Upperside.* Fore wing, ground colour tawny orange from base to the postdiscal zone, which is orange; outer border black. Cell with three strong, black, rather quadrate spots, in sub-base, mid, and at end; more elongate black spots present in the sub-bases of 7–5, 3–2, which has two spots, and double smaller spots in 1b. The margin of the wing with conspicuous orange, rather quadrate spots, double in 1b and extending to the apex. Hind wing, basal area tawny rufous shading to orange in the disc, which again shades to tawny orange on the inner fold, which is slightly edged with white and has a white spot above the anal angle. There are two small black spots in the costal area of the discal orange bar; border of wing broadly black, widest in region of cell end; marginal border with very distinct orange lunules with points directed into the strong serrations of the edge, which is black with narrow white fringe. Tails on 4 and 2, long, slender and pointed, upper 10 mm, lower 12 mm. Anal angle olive at edge, with two lilac spots. *Underside.* Fore wing, ground colour ferruginous chestnut with a strong mosaic of black marks strongly outlined in satiny white; base of costa white; cell with four black, silver-bordered spots and two longer bars in subapex; similar marks in sub-bases of 3–2, double in latter, and a large black mark in base of 1b. The orange bar of above is here represented by pale pinkish white marks large in 1b and diminishing in size, bordered distally in orange; this is followed by a complete row of white crescentic loops with contained black, small at costa, increasing in size to 1b where the mark is largely black and represented in 1a by a black streak which runs to the hind angle; the border is orange-tawny with white linear marks outlined in black along the veins thus placed between each of the more internal lunules; the edge between the border marks white. Hind wing, ground colour ferruginous chestnut with a strong pattern of black marks boldly outlined in white; cell with two such marks, followed by longer marks in 2–4, and a long mark at end of cell; the inner fold with three elongate marks; the discal zone with an irregularly edged white bar consisting of three quadrate marks at costal end, followed by an angular mark at end of cell and a more elongate triangle continued toward the hind angle and outlined in black. In the submargin is a row of silvery white quadrate marks distally bordered with black and proximally with angled marks with brownish within, most marked at upper end and becoming linear towards the hind angle where the marks are orange; the anal angle olive with two large black spots with lilac dots; border of wing tawny orange with white projections going into the strong serrations, which are black-edged and white-fringed.

FEMALE. Larger than the male, fore wing length 55 mm. Shape very similar. *Upperside.* Fore wing, ground colour paler ferruginous; pattern as in the male but bolder, the black areas more extended, those of the discal zone contiguous and reaching the hind border; the black borders of both wings broader; tails on hind wing longer. *Underside.* General pattern as in the male, but bolder.

RANGE. Madagascar.

## ***Charaxes andranodorus*** Mabille

(Pl. 16, figs 173, 174; Map 8)

*Charaxes andranodorus* Mabille, 1884 : 184.
*Charaxes cinadon* Butler, 1880*a* (*nec* Hewitson, 1870) : 335.
*Charaxes zoippus* Mabille, 1884 : 185.

MALE. Fore wing length 45–47 mm. Shape, costa slightly curved, apex bluntly pointed, outer margin only slightly incised at 3–4; edge bluntly dentate. *Upperside.* Fore wing, ground colour rufous orange, darker toward the base, brighter tawny orange in the disco-postdiscal zone; border black. Cell with three black, somewhat triangular marks of increasing size, one at mid-costa, one at subapex and the largest at end of cell; somewhat triangular black marks in sub-bases 6–5, 3–1b, that in 1b double and smaller, mark in 3 often contiguous with mark at end of cell. Irregular black marks beyond in sub-bases 7–6, with narrower spot in 4 dividing the sub-apical orange spots from the orange in the postdiscal line. Border of wing black with distinct rufous orange spots on margin. Hind wing, base of wing darker rufescent chestnut, shading to buffish rufous on the inner fold; discal band brighter rufous orange, palest at costa, where it is well defined, but merging more with the rufous of the inner fold, which has a white line on its lower edge above the hind angle. Border of wing black, margin strongly serrate with a few orange lunules at upper angle; anal angle with lilac spot and ochreous line below. Tails thin and sharply pointed, upper 6 mm, lower 9 mm, with shorter tails on 3, 5–7. *Underside.* Fore wing, costal and basal area rufous chestnut, the subcostal cell area and disc of wing crossed by bold black bars outlined in white, those in bases of 1b–3 bordering on the bold silvery white line, which crosses the postdiscal zone of the wing, widening in 1b where it is bordered with orange. The border of the wing is rufous chestnut, carrying a series of silvery white spots of decreasing size from sub-apex to 1b, increasingly edged with black proximally at the expense of the white; margin with linear white marks outlined in black along the veins in intermediate position to the submarginal spots. Hind wing, ground colour rufous chestnut, the base of the wing crossed by linked white marks with black centres, similar marks also present at the base of the wing. The inner fold with bold black and white lines linked at base above the hind angle and forming the upper arm of a white triangle above the anal angle. The disc of the wing is crossed by a bold silvery bar which curves slightly from costa to hind angle, with bold black marks on lower distal and proximal sides where the ground colour becomes orange above the anal angle; border with irregular silvery white band, outlined in black, extending from costa to above anal angle; margin with strongly marked orange border, distally accentuated by sharply pointed silvery angles, which run into the serrations of the wing, which are black edged. The serrations are thus accentuated.

FEMALE. Larger than the male, fore wing length 54–56 mm. Shape very similar. *Upperside.* Fore wing, ground colour brighter and paler than the male, but pattern essentially similar, but black marks showing up more clearly. On the hind wing, the discal orange band is more defined distally and extends further into the inner fold. The margin of the wing is strongly serrate so that each vein carries a 'tail'. The marginal border is more conspicuously orange; the bluish spots at anal angle more in evidence. *Underside.* Fore wing, pattern very similar to that of male, but the silvery white more exaggerated, especially that of the submarginal zone, including the white lunules and the white linear marks at the ends of the veins. Hind wing, pattern is also similar to that of the male but stronger, particularly the submarginal white irregular band, so also are the white angular marks at the bases of each serration on the border. The tails are long and pointed and slender, upper 13 mm, lower 10 mm; the intermediate tail on 3 is 8 mm.

RANGE. Limited to Madagascar.

## SYSTEMATIC LIST

### ***Charaxes candiope*** (Godart)

*Charaxes candiope candiope* (Godart, 1824). Type locality: Restricted to South Africa, Damaraland.
Range: Most of tropical Africa to South Africa but excluding Cape Colony.
*candiope thomasius* Staudinger, 1886. Type locality: Island of São Tomé, Gulf of Guinea.
Range: Restricted to type locality.
*candiope velox* Grant, 1899. Type locality: Sokotra, Gulf of Aden.
Range: Restricted to type locality.

### ***Charaxes cowani*** Butler

*Charaxes cowani* Butler, 1878. Type locality: Madagascar.
Range: Confined to Madagascar.

### ***Charaxes antamboulou*** Lucas

*Charaxes antamboulou* Lucas, 1872. Type locality: Madagascar.
Range: Confined to Madagascar.

### ***Charaxes analava*** Ward

*Charaxes analava* Ward, 1872. Type locality: Madagascar.
Range: Confined to Madagascar.

### *Charaxes phraortes* Doubleday

*Charaxes phraortes* Doubleday, 1847. Type locality: Madagascar.
Range: Confined to Madagascar.

### *Charaxes andranodorus* Mabille

*Charaxes andranodorus* Mabille, 1884. Type locality: Madagascar.
Range: Confined to Madagascar.

## 9. *CHARAXES VARANES* CRAMER AND ITS SUBSPECIES

### *Charaxes varanes* (Cramer)

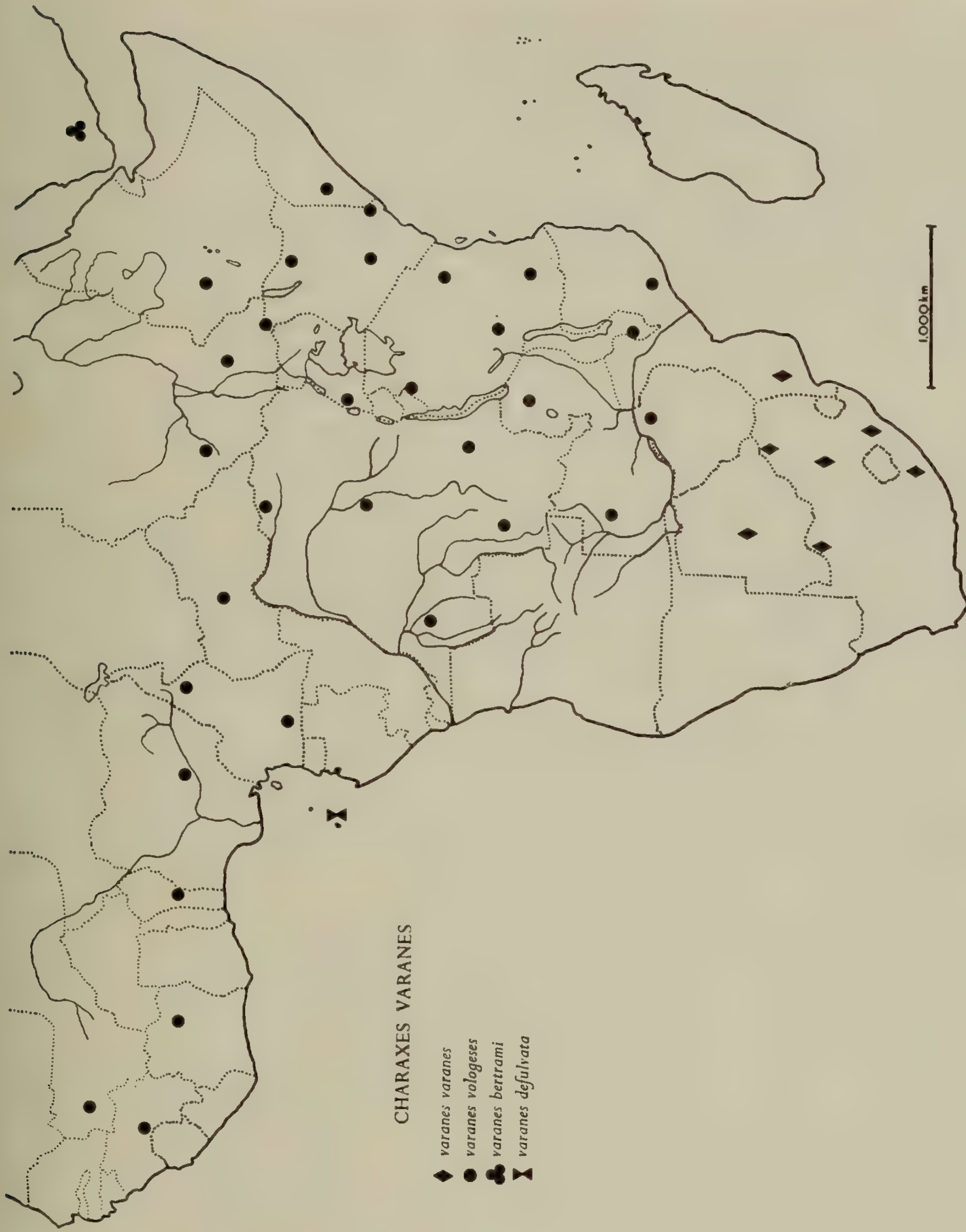
As is frequently the case in a species with a very wide distribution in Africa, from west to east and to the Cape, with food requirements equally well distributed, we find that *Charaxes varanes* does not divide up into well defined races. The extremes are easily recognized, but the representatives in eastern Africa are variable, but tending more toward the western race than the southern; in fact, the southern nominate race is restricted to South Africa.

### *Charaxes varanes varanes* (Cramer)

(Pl. 17, fig. 175; Map 9)

*Papilio Eques Achivus varanes* Cramer, 1764 : 45.
*Philognoma varanes* Wallengren, 1857 : 28.
*Palla varanes* Kirby, 1871 : 274.
*Charaxes varanes austrinus* Rothschild, 1900 : 357. =variation. **Stat. n.**

MALE. Fore wing length 40–45 mm. Shape, apex pointed, outer margin concave, hind angle projecting slightly but rounded. Hind wing, margin slightly bluntly dentate with long, slightly spatulate tail on vein 4. *Upperside.* Fore wing, basal area to end of cell yellowish, shading to orange over discal zone; border of wing beyond darker tawny chestnut. A dark line present at end of cell contiguous with a spot at base of 4, and dark spots in sub-bases 2–3; the junction of the orange with the dark band accentuated by the rows of rufous orange spots in postdiscal and submarginal lines. Hind wing basal area bluish white from mid-costal area to toward the hind angle; inner fold buffish. The white area well defined from the more tawny orange border, especially towards the costa; postdiscal line with dark spots enhancing the series of tawny orange spots in the submarginal zone which are distally bordered by dark lunules with pale spots on the margin. Tail on vein 4, 6 mm in length with rounded or spatulate end. *Underside.* Fore wing, ground colour variable from tawny buff to more rufous, with a slightly darker band on the proximal side of a dark sinuous line extending from the costa to hind margin and continuing through the hind wing. On the distal side of the fore wing line is a series of darker spots in the submarginal zone; the basal area of the wing with fine interrupted dark lines. Hind wing, basal area with similar fine lines up to the dark cross line which is distally edged with silvery buff, beyond which are satiny patches, followed by rather obscure ocelli extending from the anal angle to the costa, but that at costa very distinct, forming a very conspicuous ocellus; admargin with small triangular dark spots.


CHARAXES VARANES
◆ varanes varanes
● varanes vologeses
♣ varanes bertrami
⧗ varanes defulvata
1,000 km

MAP 9.

FEMALE. Larger than the male, fore wing length 43–46 mm. Shape very similar to that of male, but apex of fore wing slightly less pointed. *Upperside.* General coloration and pattern similar to that of male, but pale area of fore wing tending to whitish on the hind border. *Underside.* Ground colour variable, almost uniform tawny ochreous to tawny olive, or may be irrorated with fine blackish speckling with some satiny patches on the distal portion of the wings. The ocelli on the hind wing well developed; all forms with very distinct dark line crossing both wings.

RANGE. The nominate race appears to be restricted to South Africa, but intergrades with the northern aggregate in Rhodesia and the northern half of Mozambique.

### ***Charaxes varanes vologeses*** (Mabille)

(Pl. 17, figs 176–181; Map 9)

*Palla vologeses* Mabille, 1876 : 280.
*Charaxes varanes* f. *brachycauda* Le Cerf, 1923 : 367.

MALE. Fore wing length 35–45 mm. (Western examples tend to be smaller on average.) Shape, as in nominate race. *Upperside.* Fore wing, general coloration and pattern very similar to typical *varanes*, but basal area strongly white, extending from mid hind margin and base of cell, well defined from the orange discal zone in the former but merging toward the end of the cell; distal portion of wing rufous chestnut; dark line at end of cell and dark spots in bases 2–4; distal portion of wing rufous chestnut; a series of dark spots in discal line; the border with rows of tawny orange spots in postdiscal and submarginal lines extending from costa to 1b, separated by obscure dark spots; edge of wing with very narrow white in interspaces. Hind wing, basal area bluish white merging to buffish grey on inner fold above anal angle; the white area clearly defined from the rufous-chestnut border in upper half, but less defined toward the hind angle. Border with a series of dark spots, large and defined at upper angle but becoming obscured toward the hind angle; admargin with dark lunate or triangular marks and between the two rows a series of tawny orange linear marks, clearest at upper angle; edge narrowly pale buffish. Tail at vein 4 long and spatulate, 8 mm. Anal angle with black line edged white distally. There is sometimes a decided projection at end of vein 2. *Underside.* Fore wing, ground colour rather variable, basal area up to the dark cross line may be ochreous, tawny ochreous, rufescent greyish or clayish; the fore wing sometimes with a darker triangular patch on proximal side of the dark line; the pattern in the basal area often obscured but the dark zigzag fine lines, often strong against the paler ground. The dark line in the fore wing extends from the costa to 1b, and on its distal side are obscure dark lunules flanked by a series of rather obscure dark-centred ocelli in the submarginal zone, each with a dark linear mark directed toward the margin; edge of wing rather brownish. In strongly marked specimens there may be a distinct satiny line distal to the dark bar. Hind wing, basal area ochreous as fore wing, or may be suffused over, obliterating the fine dark lines, or this area may have a slight purplish brown tone. The dark bar running from the costa to above the hind angle is almost straight, it may be strong and defined or with a satiny buff edge distally, with some satiny areas beyond in which dark ocelli are situated, that at upper border strongly marked, that toward the hind angle more elongate, with a pale patch in 3; anal angle with a double light mark. The margin has a series of obscure triangular pale marks or lunules on a greenish ground with black dots distally; this row is often obliterated except for the black dots. Rothschild attempted to divide specimens into groups on the character of the undersides, but they intergrade.

FEMALE. Very similar to the male but larger, fore wing length 45–51 mm. Shape similar.

*Upperside.* Fore wing, extent of the white greater, there being less orange suffusion distally except toward the end of the cell, where the dark marks are conspicuous. The dark rufous chestnut border strong, and the tawny orange spots usually well defined. The hind wing colour and pattern differs in much the same way, the tawny orange spots may be distinct or obscured. The tail at vein 4 is more robust, 8–10 mm in length. *Underside.* As or even more variable than that of the male. Fore wing, ground colour may be pale ochreous or tawny, or even rufescent; the thin dark zigzag lines in the basal portion distinct on a pale ground, or obscured on a darker base. Similar comments apply to the pattern beyond the dark cross line, which is always well indicated as a single line or double line terminating in a dark patch in the hind angle at 1b. Hind wing, ground colour similar to that of fore wing, equally variable; the conspicuous dark bar usually strong and extending to above the hind angle where it joins at an angle with the series of crescentic dark marks, which become ocelli in the postdiscal line, especially strongly marked at the upper angle, forming a conspicuous ocellus. The marginal lunules may be strong or weak. These variations can be noted in specimens from one locality, or bred in a single family.

The above descriptions are based on specimens from Uganda and Kenya. One, however, obtains the occasional specimen with strongly yellow suffusion to the base of the fore wing, and specimens from the thorn-bush hinterland of the coastal belt closely resemble the nominate southern race. In such examples, the fore wing basal area is mainly yellow with only a trace of white on the bases of 1a–1b; the dark border is strongly rufescent, not bright chestnut, thus the orange spotting is less in contrast. On the hind wing the white area is reduced and the ground colour of the border less dark so that the dark postdiscal spots are more conspicuous and the submarginal orange spots connecting with the marginal triangles, are larger. The underside also differs in that the ground colour is more rufescent, the fore wing lacking the dark triangular patch in the mid area, and the dark cross bars of both wings may be faint. Western examples are on average smaller and are more strongly coloured, but the area of intergrading is considerable.

BIOLOGICAL NOTE. For an account of the life history *vide* Rothschild (1900 : 357–358 [extract from Trimen]) and van Someren, 1929 : 112.

RANGE. Eastern Africa from Rhodesia northward to Congo (Kinshasa) and Ethiopia; also in Angola, the Central African Republic westward to Nigeria, Sierra Leone and Guinea.

## ***Charaxes varanes bertrami*** Riley

(Pl. 18, figs 182 & 183; Map 9)

*Charaxes varanes bertrami* Riley, 1931 : 279.

MALE. A small dark race; fore wing length 36 mm; apex pointed, falcate; margin slightly dentate; hind wing rather rounded, margin dentate; tail at end of vein 4, 5 mm in length, spatulate. *Upperside.* Fore wing, differs from other races in having the basal area tawny orange, the distal portion of the wing chestnut-brown with two tawny orange spots beyond the end of the cell and indications of light marks along the junction of the two ground colours; two spots at bases of 5 & 6, and tawny orange spots in the postdiscal line and on the submarginal zone; edge with narrow whitish internervular fringe. Hind wing, basal area, including upper part of inner fold, whitish, widest at costa but angled and reduced at cell and merging with the rusty chestnut of the broad border which, in the postdiscal line, has a series of dark spots adjacent to the orange spots on the submargin; margin with obscured dark lunules; fringe white in interspaces. *Underside.* Fore wing, basal area buffish ochreous, with irregular dark lines; discal area darker rusty on proximal side of dark bar; submarginal zone with dark spots flanked on either side by tawny orange lunules. Hind wing ground colour as fore wing; wing crossed by a dark line from costa to above hind angle; a series of ocelli, well marked at costa, present in the postdiscal zone, becoming lunules at the hind angle, where they join the dark line at an angle. Submargin with darker triangular marks. Surface of both wings often freckled with dark scales. The ocellus at upper angle hind wing well marked.

FEMALE. No specimen available.

RANGE. Southern Arabia.

## ***Charaxes varanes defulvata*** Joicey & Talbot

(Pl. 18, fig. 184; Map 9)

*Charaxes varanes defulvata* Joicey & Talbot, 1926 : 22.

MALE. *Upperside.* In this very distinctive race the basal areas of both wings are in strong contrast to the dark distal portions of the wings; the orange spots are obscured, especially those of the submarginal series of the fore wing and most of the spots in the hind wing. *Underside.* The dark triangular patch in the fore wing, flanked by a pale line distally, is well marked; the dark line on the hind wing is strongly margined with whitish distally; the postdiscal and submarginal ocelli are faint except for that at the costa at upper angle, forming a conspicuous ocellus. Those at hind angle well marked. The tail is shortish but robust, 6 mm.

FEMALE. No specimen available.

RANGE. São Tomé, Gulf of Guinea.

## SYSTEMATIC LIST

### ***Charaxes varanes*** (Cramer)

*Charaxes varanes varanes* (Cramer, 1764). Type locality: Coromandel & Amboina. *Patria falsa.*
Range: South Africa; Cape Colony, Natal, Zululand, Transvaal, Kalahari.

*varanes vologeses* (Mabille, 1876). Type locality: Congo and Landana.
Range: Western Africa from Senegambia to Sierra Leone to Cameroun, Congo (Kinshasa), Gabon, Angola, Rhodesia, Zambia, Malawi, Mozambique, Tanzania, Kenya, Uganda, southern Sudan, and southern Ethiopia.

*varanes bertrami* Riley, 1931. Type locality: south-east Arabia, Quara Mts.
Range: central southern and south-east Arabia.

*varanes defulvata* Joicey & Talbot, 1926. Type locality: São Tomé, Gulf of Guinea.
Range: Confined to type locality.

## 10. *CHARAXES LYDIAE* HOLLAND

### *Charaxes lydiae* Holland

(Pl. 18, figs 191 & 192 [For map, see Map 1, Part 8])

*Charaxes lydiae* Holland, 1917 : 18.
*Charaxes lydiae* Holland; Howarth, 1969 : 38.

This very striking species appears to be very rare in collections. It was described from a single female taken in Cameroun in 1900. The type remained unique until 1963, when the late T. H. E. Jackson's African collector secured a male and a female at Ndouba, Kelle district, Republic of Congo.

I take the liberty of quoting the description given by Mr Howarth, op. cit.

'MALE. Length of fore wing 45 mm approximately, apices of both wings slightly worn. *Upperside.* The forewings are black with large white areas and spots, and the hind wings are white with white-spotted margin. In the terminal portions of the first five interspaces basad of the black border of each wing is a large and conspicuous yellow-ochre area. The black basal lines of the underside are distinctly visible on the upper surface against the white colour. *Underside.* Similar to the female except that the black spot at the base of space 2 is conspicuously larger than in the type and is confluent with the serpentine marking in the cell. The dark markings in the cell are washed with brownish-ochre.'

FEMALE. Fore wing length 55 mm. Apex of wing rather rounded, the outer margin only very slightly concave at 5–4. Base of cell ochreous in the lower half, carrying three black marks, the sub-basal line slightly angled; two contiguous rounded spots present in the sub-apex; the apex with an 'S' mark. The distal half of the wing is best described as black, ornamented with white spots, including the hind angle. There is an ovoid white spot beyond the end of the cell, and a triangular mark at base of 3; a series of bold white marks cross the wing from subcosta to hind angle, the first mark is a streak followed by triangular marks with distal ends obliquely sloped, followed by less clear-cut elongate mark in 4; a longer cylindrical mark in 5 with sloping ends; an ovoid mark in 2 followed by conjoined smaller marks in 1b. The base of the wing with a large triangular white area which covers the basal half of 2, the greater part of 1b and most of 1a. The outer ends are pointed and the bases have some ochreous scaling. The hind wing is mostly white with a diffuse area of yellowish ochre scaling in the lower quarter and anal angle. The border is strongly black, carrying a series of sub-marginal ovoid white spots, commencing at the upper angle and extending to the anal angle where the spots are double; the margin carries a series of triangular white marks, those in the region of the tails divided by black veins. The base of the wing is crossed by diffuse vertical black lines which are in fact the black lines of the underside showing through. *Underside.* This is an exact replica of the upperside pattern, especially so in the fore wing, but there is a distinct black spot at the base of 2 which is only slightly indicated on the upper side. On the hind wing the basal vertical lines are strong; the double outer line also well marked and the black scaling extends down vein 2, the other veins also clearly indicated. The spotting on the black border is similar to that above, but in addition there is a series of whitish lunules within the black at its line of junction. The suffusion of yellowish scales is present as above, but not so strong. The margin of the wing is bluntly serrate, and a strong tail is present at the end of vein 4, unfortunately with its tip missing; another tail, also broken, at end of vein 2.

This specimen is in the Jackson Collection, but will be deposited in the British Museum (Natural History).

RANGE. At present known only from the Lolodorf area of Cameroun and the

Kelle district of adjoining Republic of Congo (Brazzaville). (Moyen Congo.) [See Map 1, Part 8.]

GENERAL COMMENTS. The peculiar shape of this species is suggestive that it links *Charaxes* with *Euxanthe*. Unfortunately, nothing is known of its early stages, which might give an indication as to its relationship.

## SUPPLEMENTARY NOTES ON SPECIES DEALT WITH IN EARLIER PARTS

### ***Charaxes baumanni*** Rogenhofer.

### ***Charaxes baumanni bamptoni* subsp. n.**

(Pl. 18, figs 185 & 186)

I have recently had the opportunity to examine a small series of this species from Mt Kulal, an isolated forested mountain to the south-east of Lake Rudolf. The specimens present features which distinguish them from other described races previously dealt with in Part VII of these Revisional Notes.

MALE. Fore wing length 25–27 mm. *Upperside.* Fore wing, ground colour blue-black; the blue spots limited to a streak on hind margin in 1a, and a crescentic mark in space above, and a faint trace of a spot in 2; and a trace of a spot in 6. Hind wing, ground colour blue-black, crossed by a bluish white discal band pointed at both ends, more bluish on distal edge. Row of submarginal spots complete, but more distinct opposite tails; margined black. Tails longer than usual, upper 5–6 mm, lower 6 mm. *Underside.* More uniform brownish than in other races; the fore wing crossed by a fine white discal line, margined with black proximally. Basal triangle with the usual black dots and fine lines; some shading in post-discal zone. Hind wing ground colour as fore wing, crossed by a fine white discal line edged black proximally. Post-discal zone slightly reddish, fading out opposite tails; submarginal row of spots complete, edged black distally; admargin reddish to upper tail then olive to anal lobe, which has the usual two black spots. Tails edged black.

FEMALE. Larger than other races. Fore wing length 29–30 mm. Outer margin slightly more incised in 3–4; hind angle less rounded. *Upperside.* Fore wing, ground colour less intense black than in males. White discal band curved proximally, represented in 4–6 by three spots, upper one largest; mark in 3 triangular, quadrate in 1b–2 with a long streak in 1a The whole band narrower than in other races. The subapical white spots small and not connected with discal band. Hind wing, ground colour as fore wing; disc crossed by a narrow white band almost equal in width throughout but tapering toward hind angle. Submarginal white dots complete and distinct; admargin reddish to upper tail, then olive. Tails long, upper 7 mm, lower 6 mm, longer than in other races. *Underside.* More greyish than in male, with darker shading on proximal side of white discal band. The white subapical spots set at an angle and reaching the discal band. Margin dark. Hind wing, ground colour as fore wing and crossed by angled white band. Distal part wing darker than in other races, carrying contiguous lunate dark line in post-discal zone, submarginal lunate white dots edged black distinct. Admargin slightly reddish to upper tail.

Holotype male. KENYA; Northern Frontier District, Mt Kulal, 6,200 ft, 6.iii.1972 (*Ivan Bampton*). In British Museum (Natural History).

Allotype female. Same data as holotype. In British Museum (Natural History).

Paratypes, 1 ♂, 3 ♀: Same data as holotype (in Bampton coll.).

## ***Charaxes martini*** van Someren

(Pl. 18, figs 187, 188)

*Charaxes martini* van Someren, 1966 : 96.

When I described this species in Part III from a few males, the female was unknown. Since then two females have been taken in the type locality at 300 feet on Mt Mlanje, Malawi. The specimen taken by P. T. Martin is in sufficiently good condition on which to base a description.

FEMALE. Fore wing length 36 mm; apex somewhat pointed but outer margin only slightly incurved at 3–4. *Upperside.* Ground colour black with very slight greenish tinge toward base especially in the cell. Discal row of pale creamy spots interrupted in 4, subcostal spot elongate, followed by a smaller spot in 5, the spots from 3 to hind margin of increasing size, that on the hind margin elongate and contiguous with the series of postdiscal creamy spots in 1b, the spots in 2–4 of equal size and at a slight angle with the subapical spots in 5–7. Extreme edge of wing with very slight white internervular fringe. Hind wing ground colour black; disc of wing crossed by a creamy bar, widest at the costa, 6 mm, tapering slightly to 2, inner border slightly tinged with greenish due to the longish hair-like scales toward the inner fold, the outer border more tinged with greenish grey; a series of linear white marks on submargin, followed by maroon lunules from 5 to upper tail, the lunules becoming greenish at anal angle; extreme edge black. Unfortunately, the tails are missing except that on vein 4 which is 6 mm long, black with white median line. *Underside.* Fore wing ground colour silvery grey; the cell with a black spot at base and two spots, one above the other, beyond; a wavy line present at about mid point and a thinner line toward end. A dark bar crosses the wing in the discal line, the margins accentuated by black, so that this bar accentuates the inner edge of the white bar above, which is here somewhat enlarged and distally bordered by a darker line separating the discal white from the postdiscal series of pale dyslegnic spots in its upper part, but bordered with brownish in the curve of the wing, in its lower portion accentuated by black lunate marks in 1b–2 and by black tornal 'eye-spots', double in 1b. Hind wing ground colour as fore wing, but base with a brownish grey 'V', base toward costa and enclosing a whitish line, defined from the whitish inner fold and more so on its distal side by the white cross bar in discal zone, which is accentuated proximally with blackish lines and distally by a series of greenish grey lunules outlined in black proximally and shaded with chestnut distally; the submargin silvery grey, distally bordered by reddish lunules above the tail and more greenish at anal angle; margin white finely edged with black.

Neallotype female. MALAWI: Milosa Stream, Mt Mlanje, 3000 ft, 17.x.68 (*P. T. Martin*).

A second female was subsequently caught by Dr McCleery at the same spot and, as it was very damaged, it was caged with possible food plants, but refused to lay.

On the upperside, this female is somewhat reminiscent of the white-barred female of *Ch. ethalion*, but the series of postdiscal spots is more creamy and less angled at 3–4. The underside is rather similar to *Ch. contrarius* Weymer, which does not occur in southern Malawi.

## ***Charaxes lactitinctus*** Karsch

(Pl. 18, figs 189 & 190)

*Charaxes lactitinctus ungemachi* Le Cerf, 1927 : 144.

When this subspecies from Ethiopia was dealt with in these Revisional Notes

(Part VIII, p. 235), only photographs of a ♀ paratype were available. Through the kindness of Dr P. Viette, of the Museum National d'Histoire Naturelle, Paris, it is now possible to illustrate the holotype male and allotype female.

## ACKNOWLEDGMENTS

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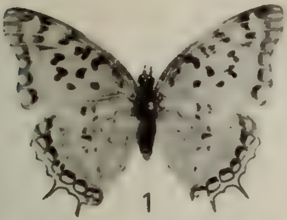
Dr Victor Gurner Logan van Someren
The Sanctuary, Ngong
P.O. Box 24947
Karen, Kenya

## PLATE 1

### *Charaxes jahlusa Trimen*

Upper & undersides

| | |
|---|---|
| Figs 1 & 2. | *jahlusa* Trimen, ♀ Type (South Africa: Cape, Grahamstown, Bashee River). Photos B.M.(N.H.) Nos 39910–11. |
| Fig. 3. | *jahlusa* Trimen, ♂ (South Africa: Cape, Vogelstruislaagte). |
| Fig. 4. | *jahlusa* Trimen, ♂ cline to *argynnides* (South Africa: Transvaal, Hammanskrall). |
| Fig. 5. | *jahlusa* Trimen, ♂ cline to *argynnides* (South Africa: Transvaal, Saltpan). |
| Fig. 6. | *argynnides* Westwood, ♂ (Malawi: Monkey Bay). |
| Figs 7–9. | *argynnides* Westwood, ♀♀ (Malawi: Monkey Bay). |
| Fig. 10. | *kenyensis* Joicey & Talbot, ♂ (Kenya Coast, Watamu, Aboni Forest). |
| Fig. 11. | *kenyensis* Joicey & Talbot, ♀ (Kenya Coast, Kilifi, Watamu, Aboni Forest). |
| Figs 12 & 13. | *kenyensis* form *pallene* forma n., ♂♂ (Kenya: Kibwezi). |
| Figs 14 & 15. | *kenyensis* form *pallene* forma n., ♀♀ (Kenya: Kibwezi). |
| Fig. 16. | *kenyensis* cline to *ganalensis* Carpenter, ♂ (Uganda: Suk-Karamoja). |
| Figs 17 & 18. | *kigoma* subsp. n., ♂ Holotype (Tanganyika: [Tanzania] Kigoma, Mukuyu, x.1964). |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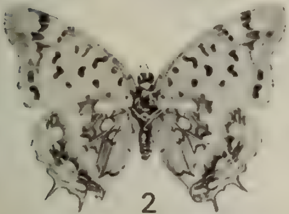
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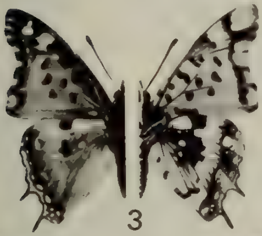
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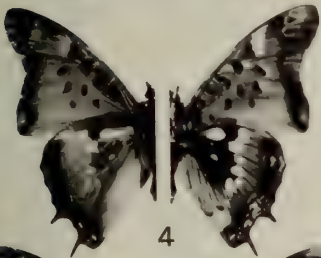
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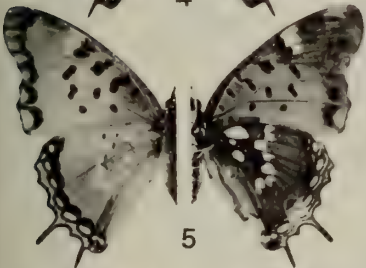
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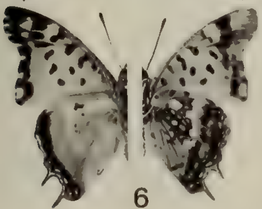
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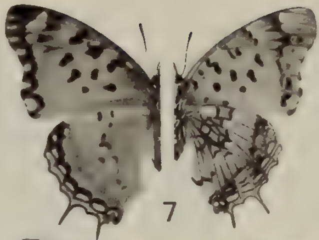
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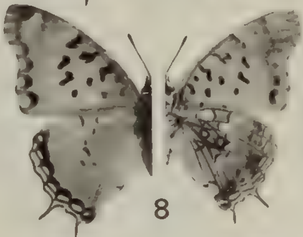
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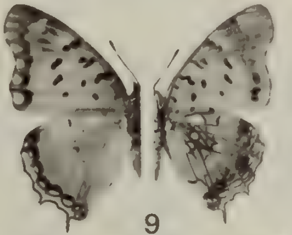
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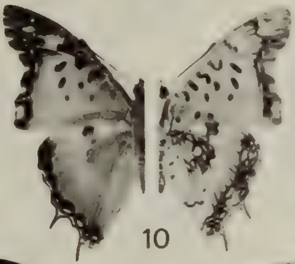
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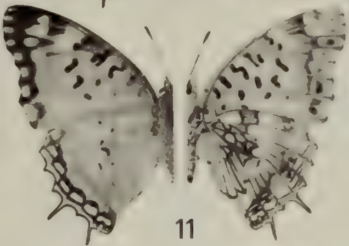
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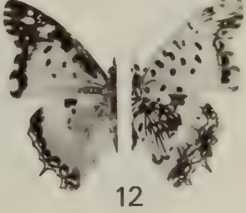
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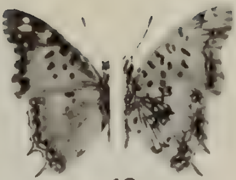
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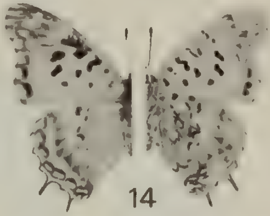
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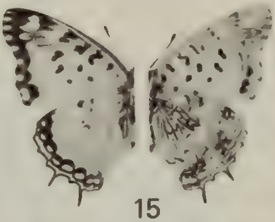
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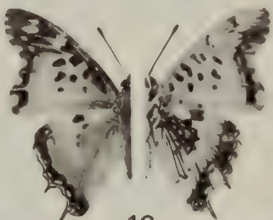
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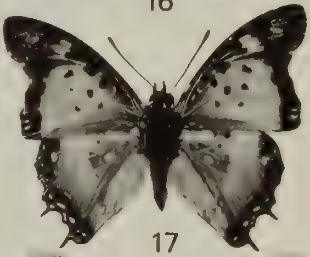
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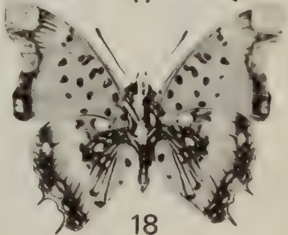
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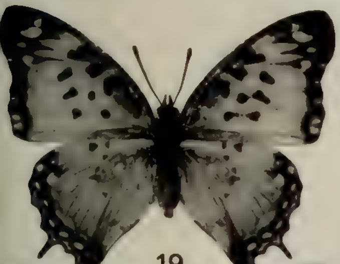
## PLATE 2

*Charaxes*

Upper & undersides

| | |
|---|---|
| FIGS 19 & 20. | *jahlusa kigoma* subsp. n., ♀ Allotype (Tanzania: Kigoma, x.1964). |
| FIG. 21. | *paphianus paphianus* Ward, ♂ (Gold Coast [Ghana]). |
| FIG. 22. | *paphianus paphianus* Ward, ♂ (W. Congo). |
| FIG. 23. | *paphianus paphianus* Ward, ♀ (Cameroun). |
| FIG. 24. | *paphianus subpallida* Joicey & Talbot, ♀ (Uganda: Bwamba). |
| FIG. 25. | *paphianus subpallida* Joicey & Talbot, ♂ (Uganda: Kayonza). |
| FIGS 26 & 27. | *paphianus subpallida* Joicey & Talbot, ♂ Type (Congo: Upper Maiko). Photos B.M. (N.H.) Nos 50122–3. |
| FIGS 28 & 29. | *paphianus subpallida* Joicey & Talbot, ♀ Type (Congo: Lubutu). Photos B.M. (N.H.) Nos 50124–5. |
| FIG. 30. | *pleione pleione* (Godart), ♂ (Cameroun). |
| FIG. 31. | *pleione pleione* (Godart), ♂ (Sierra Leone). |
| FIG. 32. | *pleione pleione* (Godart), ♂ (Cameroun). |
| FIG. 33. | *pleione pleione* (Godart), ♀ (Cameroun). |
| FIG. 34. | *pleione pleione* (Godart), ♀ (Ghana). |
| FIG. 35. | *pleione pleione* (Godart), ♀ (Cameroun). |
| FIG. 36. | *pleione bebra* Rothschild, ♂ (Uganda: Mpanga). |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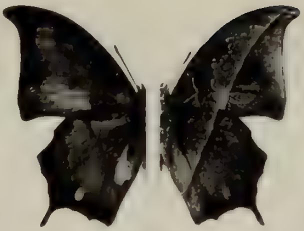
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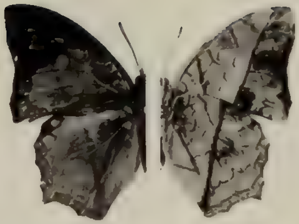
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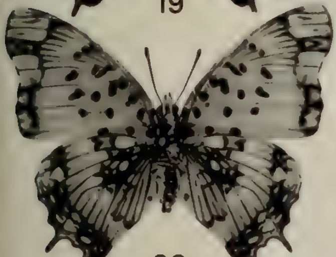
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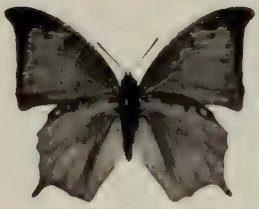
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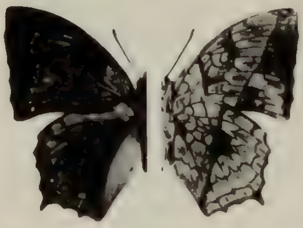
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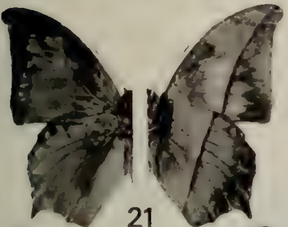
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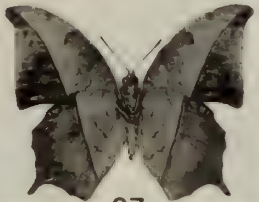
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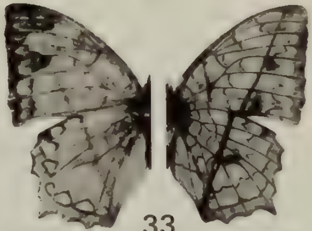
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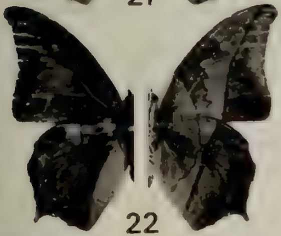
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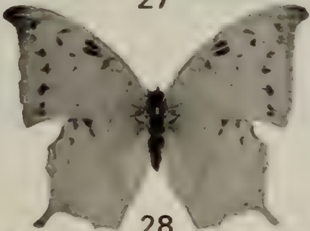
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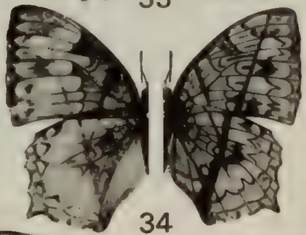
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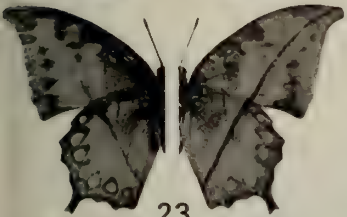
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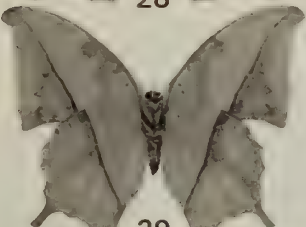
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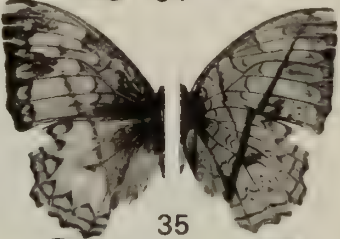
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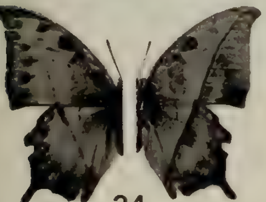
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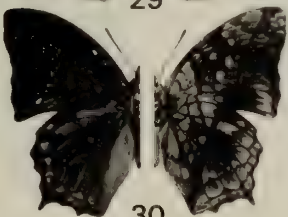
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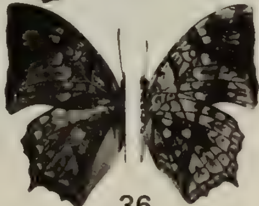
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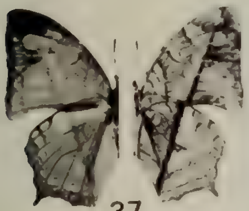
## PLATE 3

*Charaxes*

Upper & undersides

FIG. 37. *pleione bebra* Rothschild, ♂ (Uganda: Katera).
FIG. 38. *pleione bebra* Rothschild, ♀ (Uganda: Mpanga).
FIG. 39. *pleione bebra* Rothschild, ♀ (Congo: Bwamba).
FIG. 40. *pleione bebra* Rothschild, ♀ (Uganda: Kalinzu).
FIG. 41. *pleione bebra* Rothschild, ♂ (Kenya: Shimba Hills).
FIG. 42. *pleione bebra* Rothschild, ♀ (Tanzania: Amani).
FIG. 43. *acraeoides* Druce, ♂.
FIG. 44. *fournierae fournierae* Le Moult, ♂ (Congo: Etoumbi). Photos B.M.(N.H.) Nos 52666–7.
FIG. 45. *fournierae fournierae* Le Moult, ♀ Neallotype (Congo: Etoumbi). Photos B.M.(N.H.) Nos 52670–1.
FIG. 46. *fournierae kigeziensis* Howarth, ♂ Holotype (Uganda: Kigezi, Kayonza Forest) (*van Someren*). Photos B.M.(N.H.) Nos 52662–3.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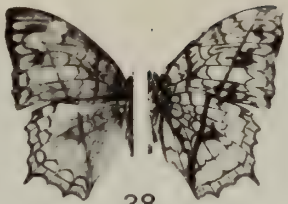
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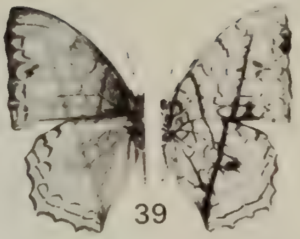
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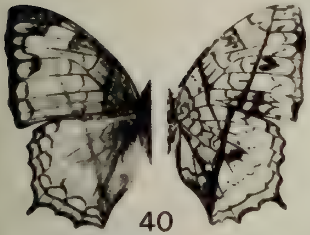
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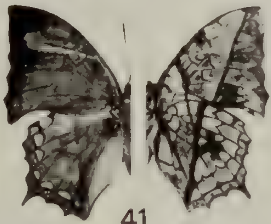
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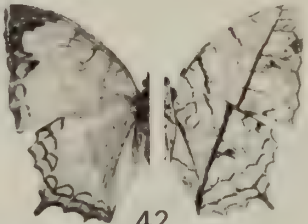
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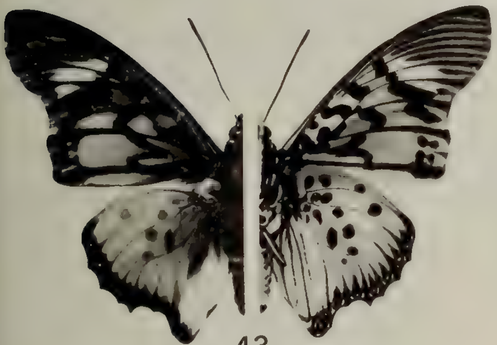
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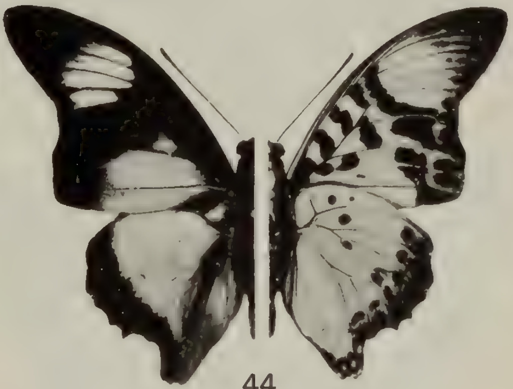
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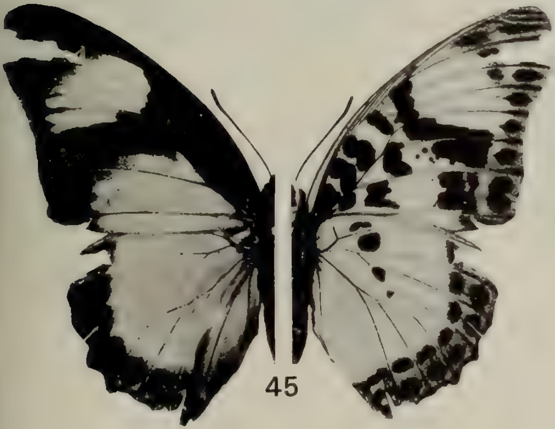
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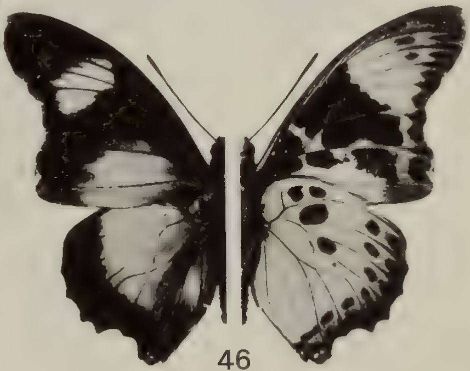
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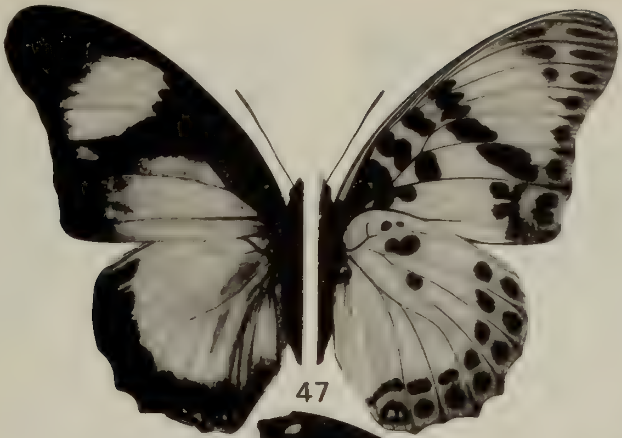
## PLATE 4

### *Charaxes*

### Upper & undersides

| | |
|---|---|
| Fig. 47. | *fournierae kigeziensis* Howarth, ♀ Allotype (Uganda: Kigezi, Kayonza Forest) (*van Someren*). Photos B.M.(N.H.) Nos 52672–3. |
| Figs 48 & 50. | *nobilis nobilis* Druce, ♂ Type (Nigeria: Old Calabar). Photos B.M.(N.H.) Nos 52664–5. |
| Figs 49 & 51. | *nobilis nobilis* Druce, ♀ Type of *agabo* Distant, syn. (Nigeria: Calabar). Photos B.M.(N.H.) Nos 52660–1. |
| Fig. 52. | *nobilis nobilis* Druce, ♀ (French Equat. Afr. [Congo, Brazzaville] Ouesso, Mambili Forest) (*T. H. E. Jackson*). Photos B.M.(N.H.) Nos 52668–9. |
| Fig. 53. | *nobilis rosemariae* Rousseau-Decelle, ♂ (Congo: Katanga, Kafakumba). Photos I. Grahame. |



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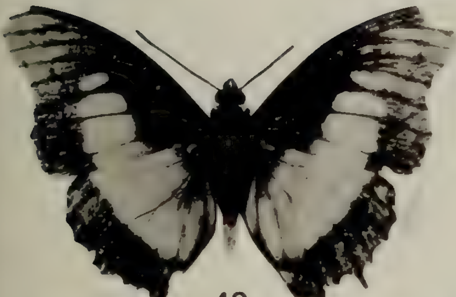

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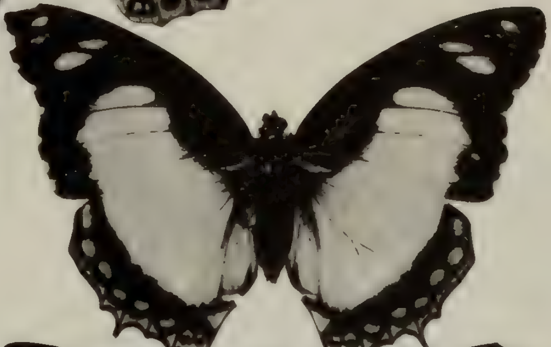

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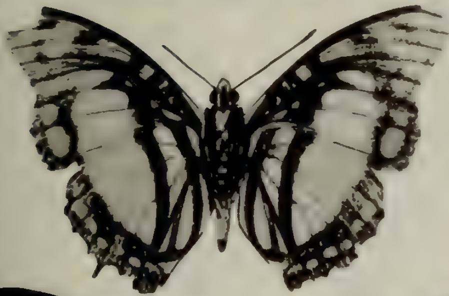

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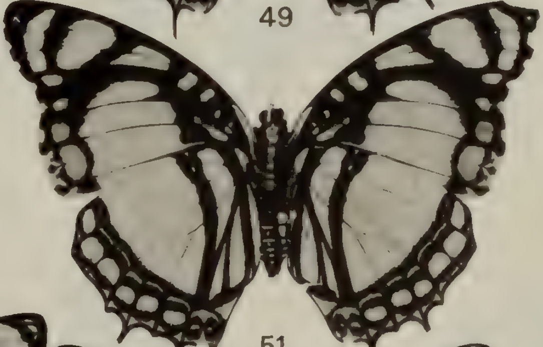

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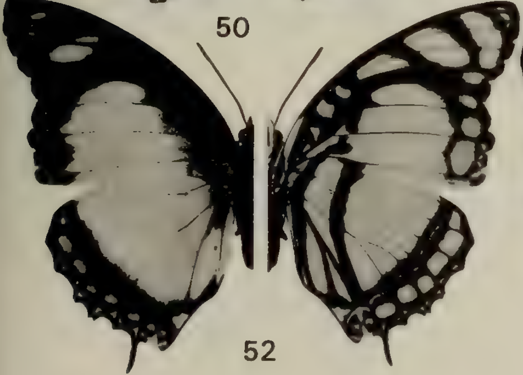

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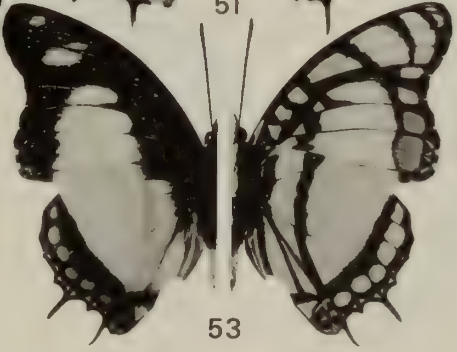


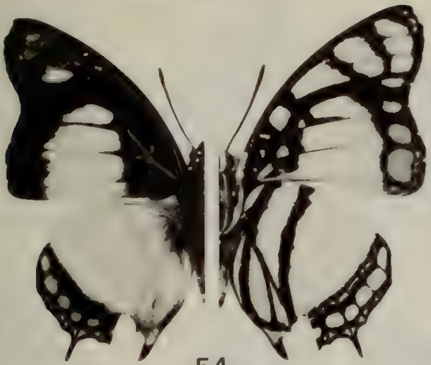
53

## PLATE 5

*Charaxes*

Upper & undersides

FIG. 54. *nobilis rosemariae* Rousseau-Decelle, ♂ (Uganda: Kalinzu Forest).
FIG. 55. *nobilis rosemariae* Rousseau-Decelle, ♀ (Congo: Katanga, Kafakumba).
Photos I. Grahame.
FIG. 56. *nobilis nobilis* Druce, ♂ (Nigeria).
FIG. 57. *nobilis claudei* Le Moult, ♂ (Guinea).
FIG. 58. *nobilis claudei* Le Moult, ♀ (Ivory Coast: Abidjan). Photos J. Plantrou.
FIG. 59. *superbus* Schultze, ♂ (Congo: Ouesso). Photos B.M.(N.H.)Nos 38815–6.
FIG. 60. *superbus* Schultze, ♀ Neallotype (Cameroun) (*Merle*). Photos J. Plantrou.



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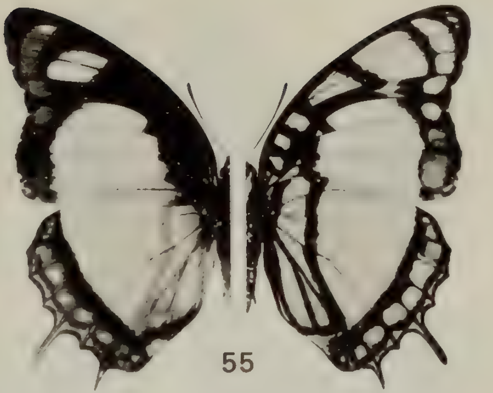

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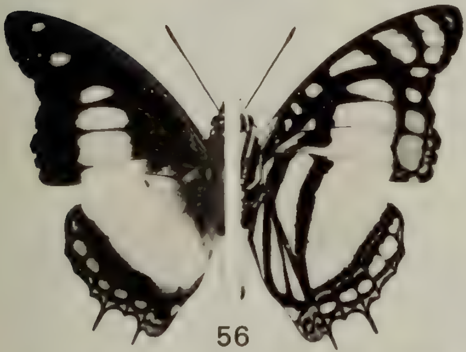

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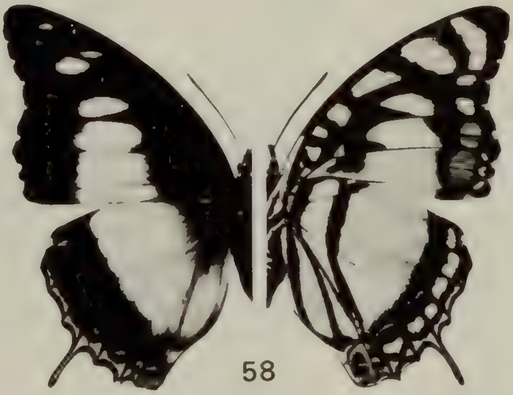

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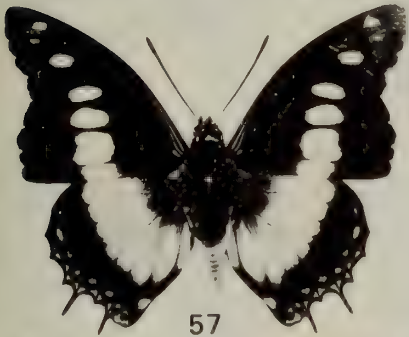

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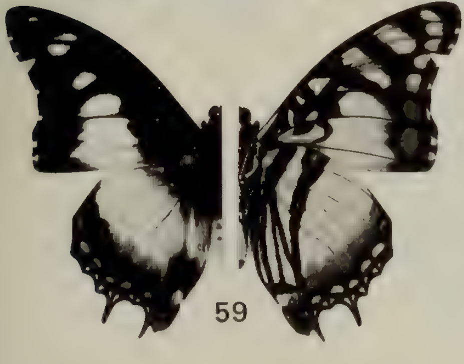

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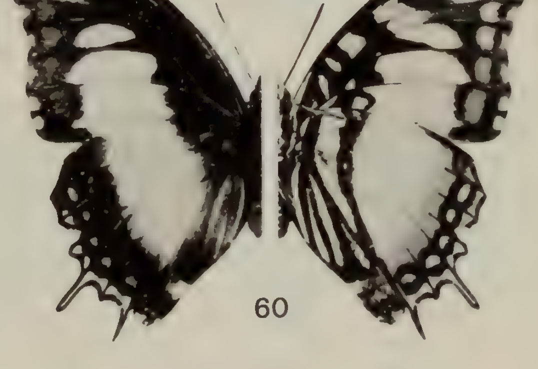


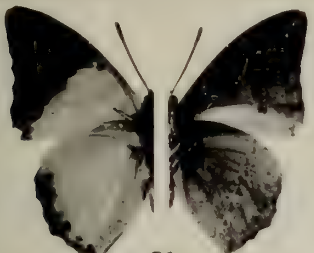
60

## PLATE 6

*Charaxes*

Upper & undersides

| | |
|---|---|
| Fig. 61. | *eupale eupale* (Drury), ♂ (Ivory Coast). |
| Fig. 62. | *eupale eupale* (Drury), ♀ (Ivory Coast). |
| Fig. 63. | *eupale eupale* (Drury), ♂ (Ghana). |
| Fig. 64. | *eupale eupale* (Drury), ♀ (Ivory Coast). |
| Figs 65–67. | *eupale latimargo* Joicey & Talbot, ♂♂ (Uganda). |
| Figs 68 & 69. | *eupale latimargo* Joicey & Talbot, ♀♀ (Uganda). |
| Fig. 70. | *subornatus subornatus* Schultze, ♂ (Cameroun). |
| Fig. 71. | *subornatus subornatus* Schultze, ♀ (Central African Republic). |
| Fig. 72. | *subornatus minor* Joicey & Talbot, ♂ (Uganda). |
| Figs 73 & 74. | *dilutus dilutus* Rothschild, ♂♂ (Nyasaland: [Malawi]). |
| Fig. 75. | *dilutus dilutus* Rothschild, ♀ (Nyasaland: [Malawi]). |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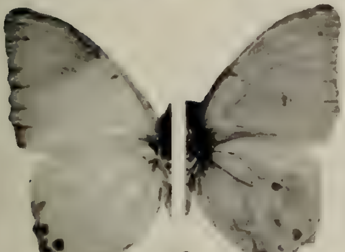
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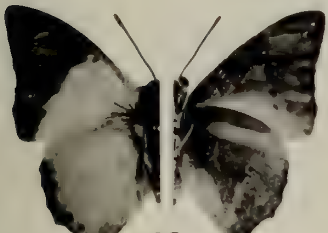
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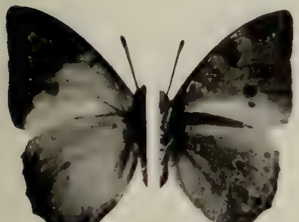
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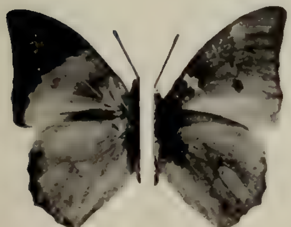
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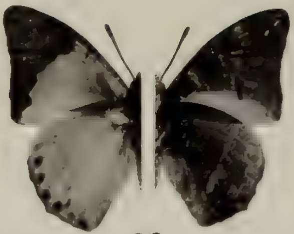
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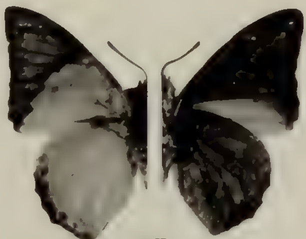
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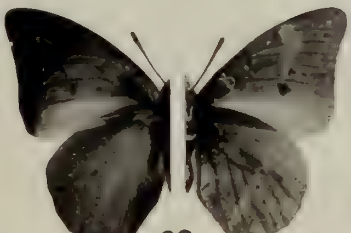
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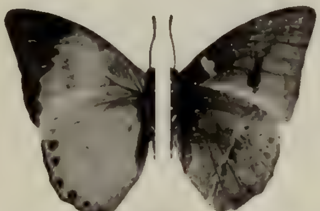
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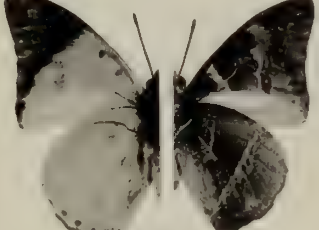
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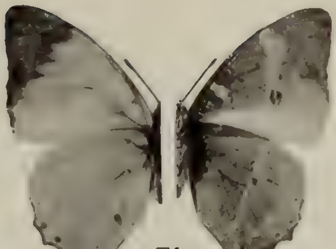
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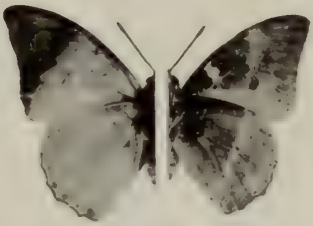
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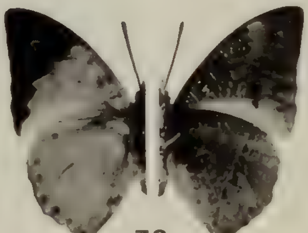
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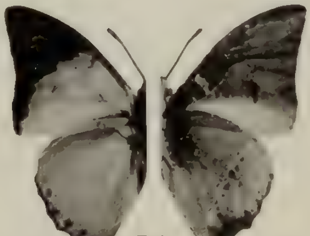
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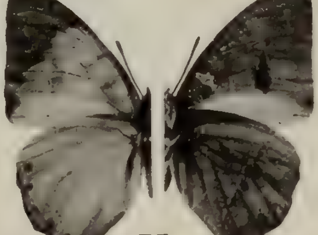
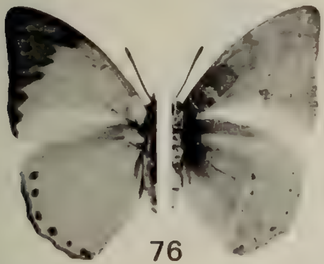

75

## PLATE 7

*Charaxes*

Upper & undersides

Fig. 76. *dilutus dilutus* Rothschild, ♀ (Zambia).
Fig. 77. *dilutus ngonga* subsp. n. ♂ Holotype (Kenya: Ngong) (*van Someren*).
Fig. 78. *dilutus ngonga* subsp. n. ♀ Allotype (Kenya: Ngong).
Fig. 79. *dilutus ngonga* subsp. n. ♀ Paratype (Kenya: Ngong) (*van Someren*).
Fig. 80. *montis* Jackson, ♂ (S.W. Uganda: Kigezi district, Mafuga Forest).
Fig. 81. *montis* Jackson, ♀ (S.W. Uganda: Kigezi district, Mafuga Forest).
Figs 82–84. *zoolina zoolina* (Westwood), ♂♂ (Kenya: Ukambani, Kibwezi).
Figs 85 & 86. *zoolina zoolina* (Westwood), ♀♀ (Kenya Coast to Rift Valley).
Figs 87–89. *zoolina* from *neanthes* (Hewitson), ♂♂ (Kenya Coast to Nairobi).
Fig. 90. *zoolina* form *neanthes* (Hewitson), ♀ (Kenya Coast to Nairobi).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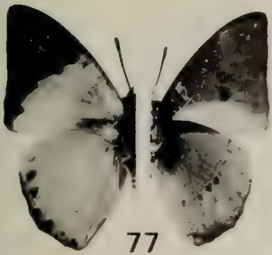
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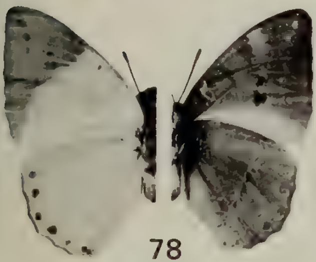
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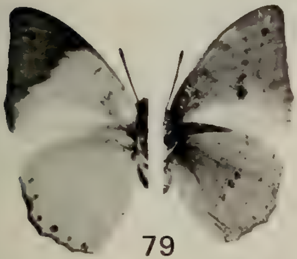
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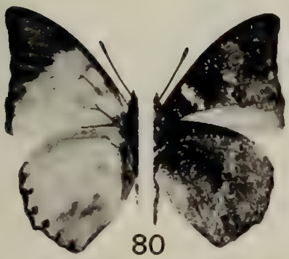
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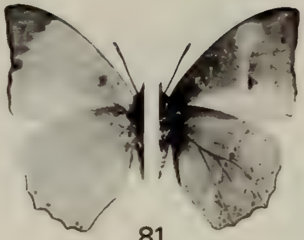
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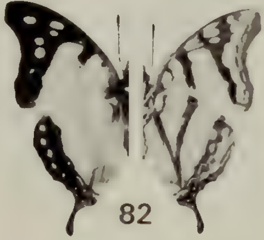
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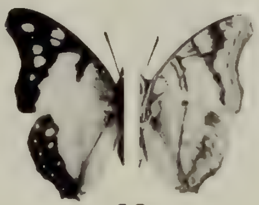
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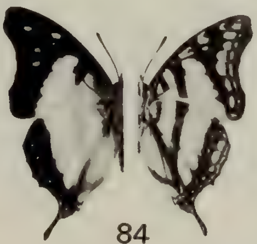
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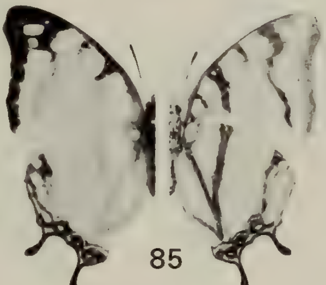
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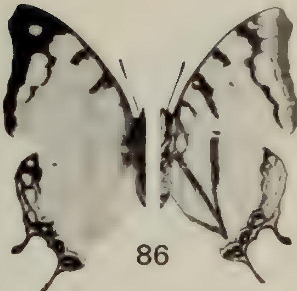
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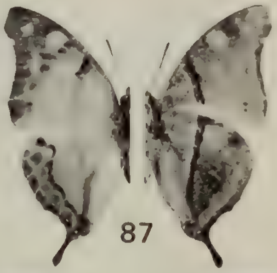
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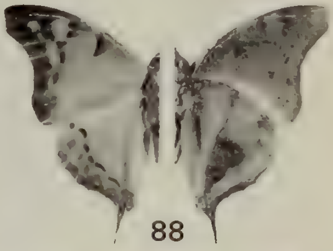
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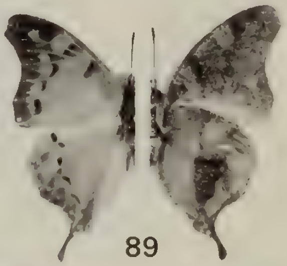
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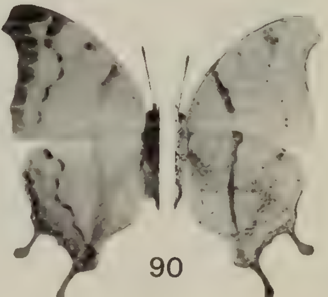
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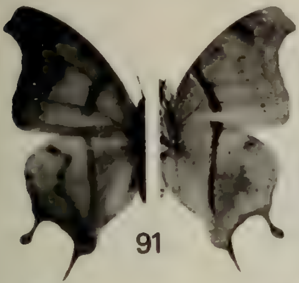
## PLATE 8

*Charaxes*

Upper & undersides

| | |
|---|---|
| Figs 91 & 92. | *zoolina* form *neanthes* Hewitson, ♀♀ (Kenya Coast to Nairobi). |
| Fig. 93. | *zoolina mafugensis* Jackson, ♂ (Uganda: Mafuga Forest). |
| Fig. 94. | *zoolina mafugensis* Jackson, ♂ (Uganda: Kigezi district, Mafuga Forest, Upper Impenetrable Forest). |
| Fig. 95. | *zoolina mafugensis* Jackson, ♀ (Uganda: Kigezi district, Mafuga Forest). |
| Fig. 96. | *zoolina mafugensis* Jackson, ♂ (Uganda: Kigezi district, Mafuga Forest). |
| Figs 97 & 98. | *zoolina betsimisaraka* Lucas, ♂♂ (Madagascar). |
| Fig. 99. | *zoolina betsimisaraka* form *betanimena* Lucas, ♂ (Madagascar). |
| Fig. 100. | *zoolina betsimisaraka* form *betanimena* Lucas, ♀ (Madagascar). |
| Figs 101 & 102. | *kahldeni* Homeyer & Dewitz, ♂ (Uganda: Bwamba Valley). |
| Fig. 103. | *kahldeni* Homeyer & Dewitz, ♀ (Uganda: Bwamba Valley). |
| Fig. 104. | *kahldeni* form *homeyeri* Homeyer & Dewitz, ♂ (Uganda: Bwamba Valley & Bugoma Forest). |
| Fig. 105. | *kahldeni* form *homeyeri* Homeyer & Dewitz, ♀ (Central African Republic: Bangui). Photo J. Plantrou. |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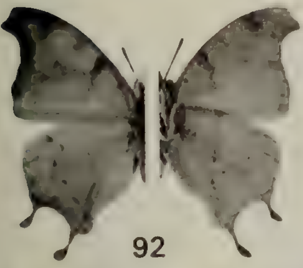
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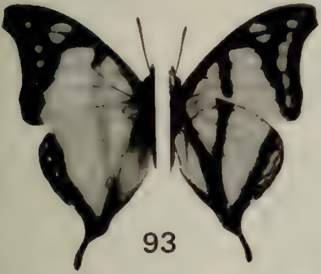
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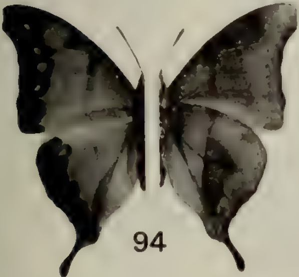
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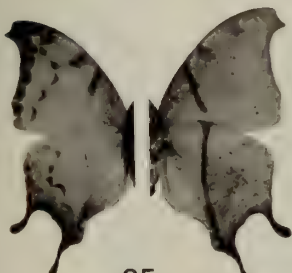
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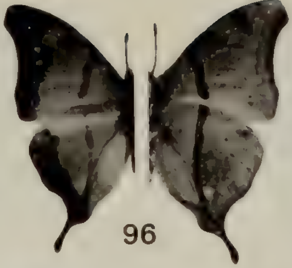
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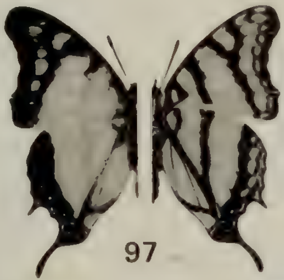
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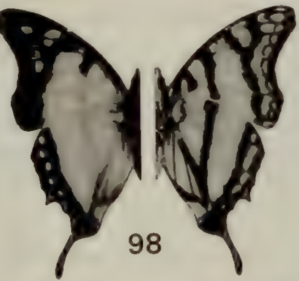
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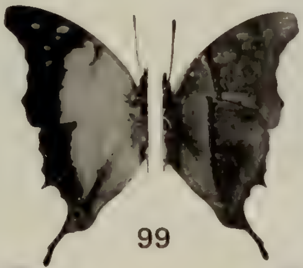
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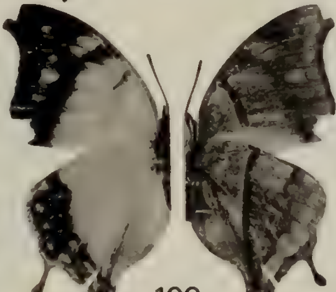
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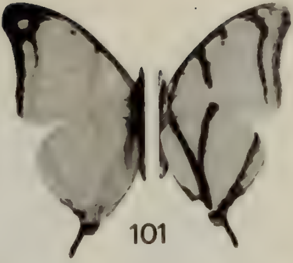
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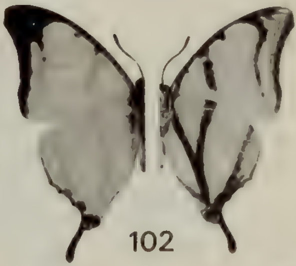
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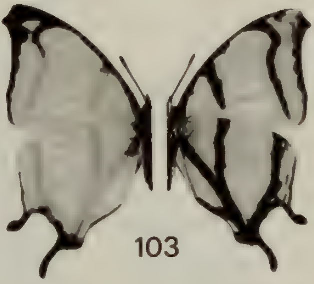
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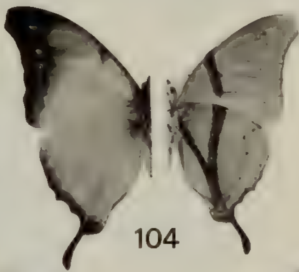
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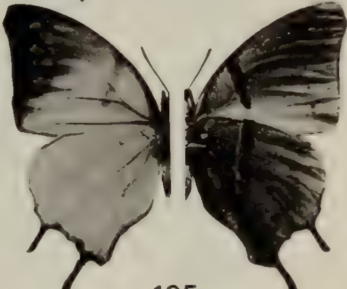
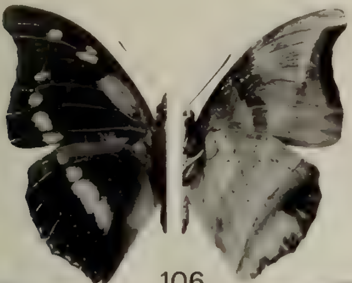

105

## PLATE 9

*Charaxes*

Upper & undersides

| | |
|---|---|
| FIG. 106. | *mycerina* Godart, ♂ (Ivory Coast). |
| FIG. 107. | *mycerina* Godart, ♀ (Congo). |
| FIG. 108. | *mycerina* Godart, ♀ (Ivory Coast). |
| FIG. 109. | *porthos dummeri* Joicey & Talbot, ♂ (Uganda) (*van Someren*). |
| FIG. 110. | *doubledayi* Aurivillius, ♂ (Congo). |
| FIG. 111. | *doubledayi* Aurivillius, ♀ (Congo). |
| FIGS 112 & 113. | *porthos porthos* Grose-Smith, ♂ ♂ (Cameroun). |
| FIGS 114 & 115. | *porthos katangae* Rousseau-Decelle, ♂ Holotype (Congo: Katanga, Kafakumba).<br>Photos I. Grahame. |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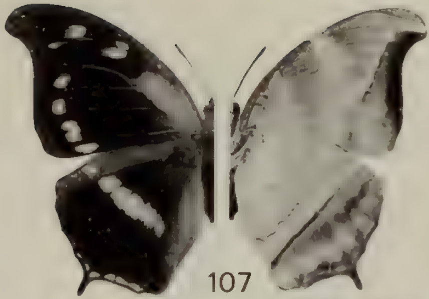
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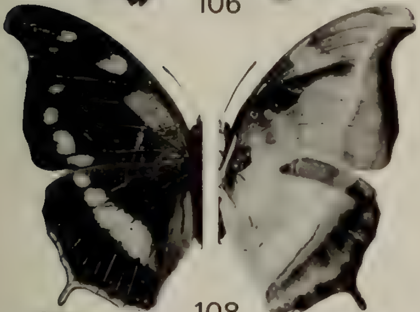
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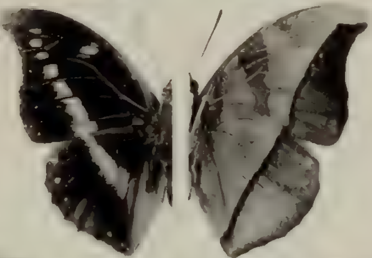
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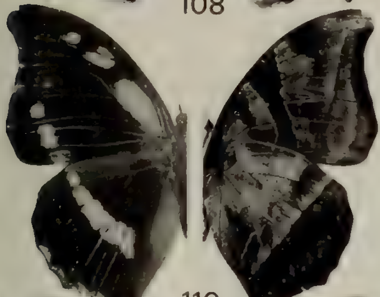
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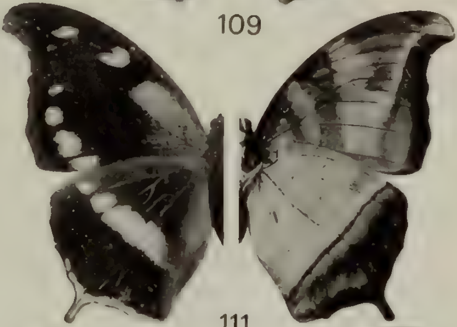
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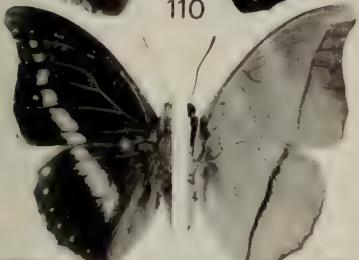
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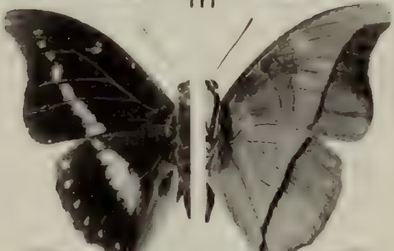
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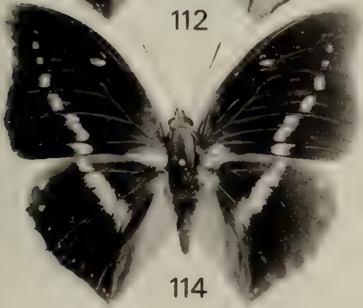
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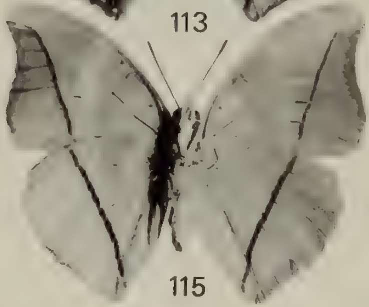
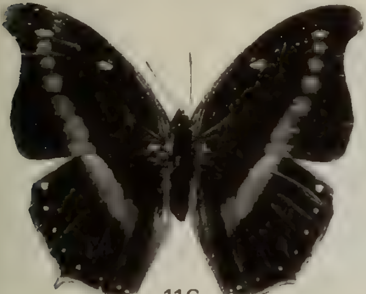

115

## PLATE 10

*Charaxes*

Upper & undersides

Figs 116 & 117. *porthos dummeri* Joicey & Talbot, ♀ Neallotype (Uganda: Mabira Forest). Photos B.M.(N.H.) Nos 50130–1.
Fig. 118. *porthos gallayi* van Someren, ♂ Holotype (Ivory Coast: Divo) (*A. Gallay*).
Fig. 119. *porthos gallayi* van Someren, ♂ Paratype (Ivory Coast: Divo) (*A. Gallay*).
Fig. 120. *porthos gallayi* van Someren, ♀ Allotype (Ivory Coast: Divo) (*A. Gallay*).
Fig. 121. *porthos gallayi* van Someren, ♀ Paratype (Ivory Coast: Divo) (*A. Gallay*). Dark area at base of wings are stains. (Figs 118–121).
Figs 122 & 123. *zelica zelica* Butler, ♂ Type (Ghana: Ashanti).
Fig. 124. *zelica zelica* Butler, ♂ (Ivory Coast).
Fig. 125. *zelica zelica* Butler, ♂ cline to *depuncta* (Cameroun).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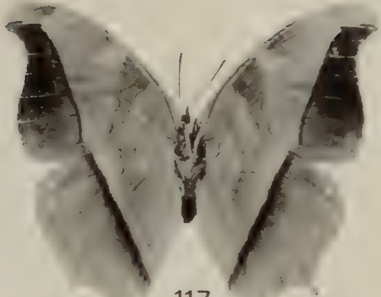
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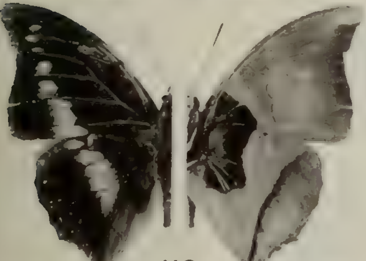
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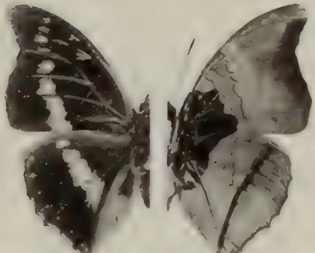
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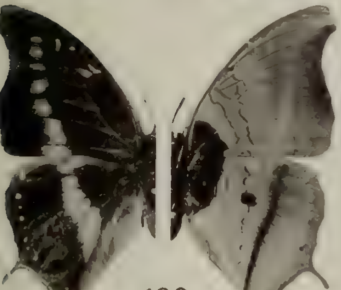
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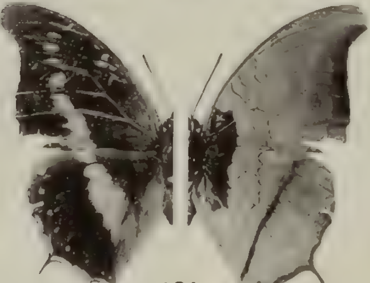
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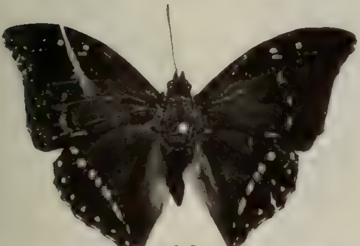
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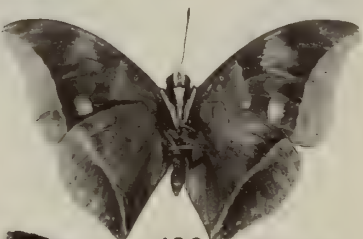
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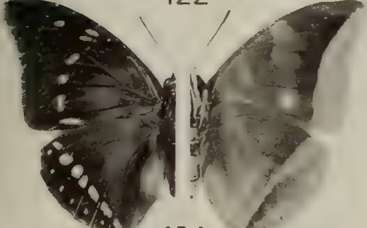
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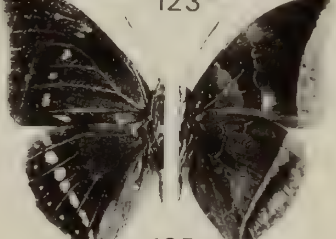
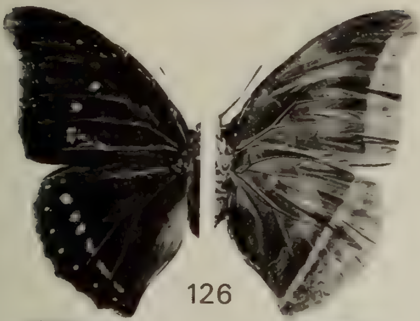

125

# PLATE 11

## *Charaxes*

### Upper & undersides

| | |
|---|---|
| FIG. 126. | *zelica zelica* Butler, ♀ cline to *depuncta* (Central African Republic: Bangui). Photos J. Plantrou. |
| FIG. 127. | *zelica depuncta* Joicey & Talbot, ♂ (Uganda: Mawakota). |
| FIGS 128 & 129. | *zelica depuncta* Joicey & Talbot, ♂ Holotype (Uganda). Photos B.M.(N.H.) Nos 50128–9. |
| FIG. 130. | *zelica depuncta* Joicey & Talbot, ♀ (Uganda: Chagwe). |
| FIG. 131. | *zelica zelica* Butler, ♂ cline to *depuncta* (southern Congo: Katanga, Kafakumba) (*C. H. McCleery*). |
| FIG. 132. | *zelica toyoshimai* Carcasson, ♂ (Tanzania north-east of Lake Tanganyika, Kigoma district). |
| FIG. 133. | *laodice* Drury, ♂ (Congo: Coquilhatville). |
| FIG. 134. | *laodice* Drury, ♀ (Congo). |
| FIG. 135. | *laodice* Drury, ♂ (Ivory Coast). |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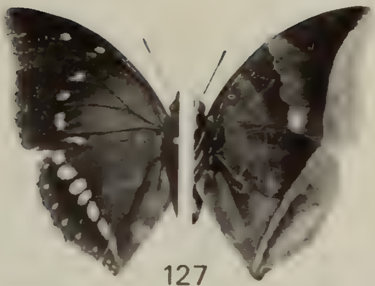
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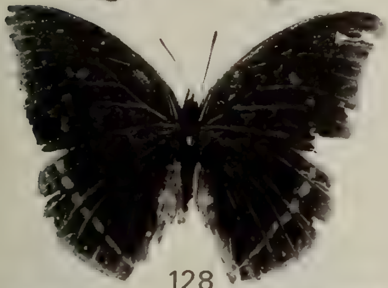
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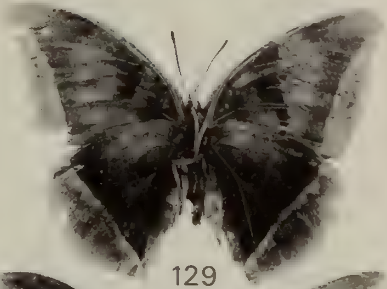
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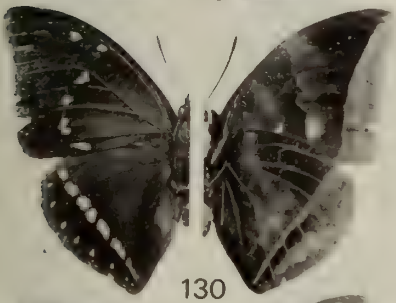
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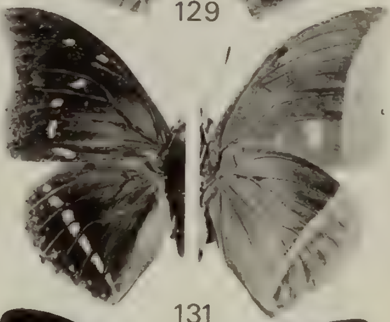
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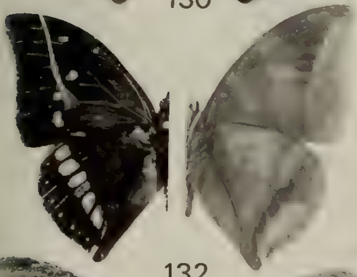
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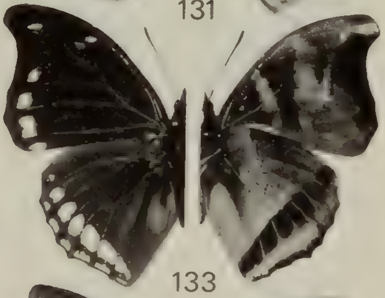
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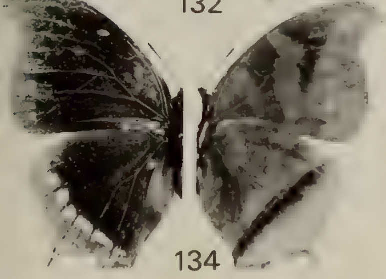
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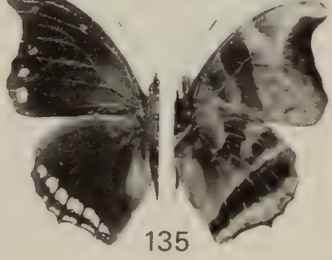
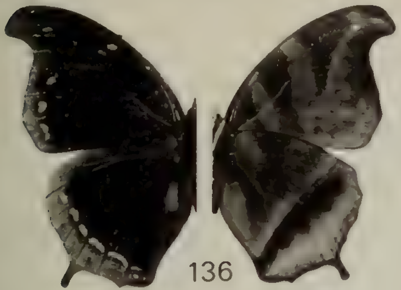

135

## PLATE 12

*Charaxes*

Upper & undersides

| | |
|---|---|
| Fig. 136. | *laodice* Drury, ♀ (Ivory Coast). |
| Figs 137 & 138. | *laodice* subsp. ?, ♂♂ (Tanzania: Kigoma district). |
| Fig. 139 | *laodice* subsp. ?, ♂ (Sudan: Nuba Mtns, south-west of El Obeid). |
| Fig. 140. | *dunkeli* Röber, ♂ (Cameroun). Photos J. Plantrou. |
| Fig. 141 | *nichetes nichetes* Grose-Smith, ♂ (Western Congo: Coquilhatville). |
| Fig. 142. | *nichetes nichetes* Grose-Smith, ♀ (Western Congo: Coquilhatville). |
| Fig. 143. | *nichetes nichetes* Grose-Smith, ♂ (Uganda: Sesse Islands). |
| Fig. 144. | *nichetes nichetes* Grose-Smith, ♀ (Uganda: Sesse Islands). |
| Fig. 145. | *nichetes leonius* Butler, ♂ (Malawi). |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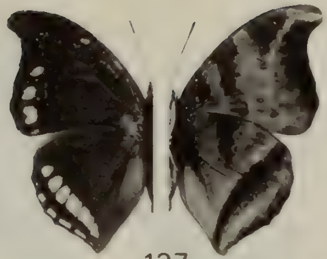
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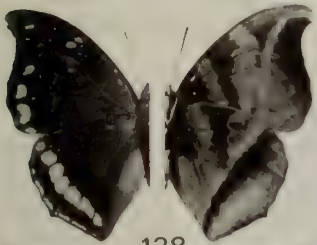
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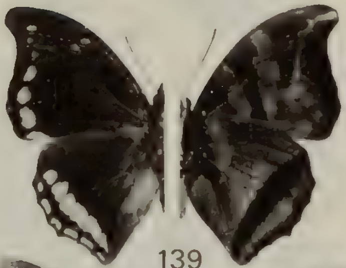
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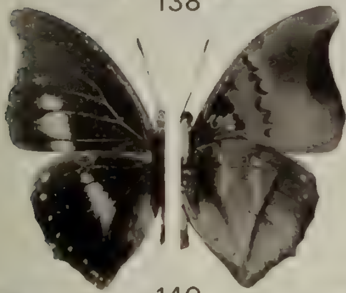
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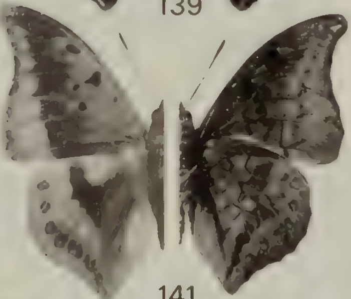
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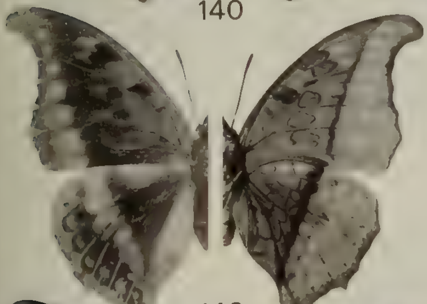
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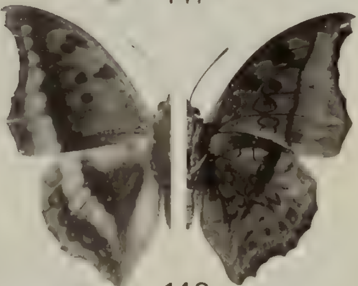
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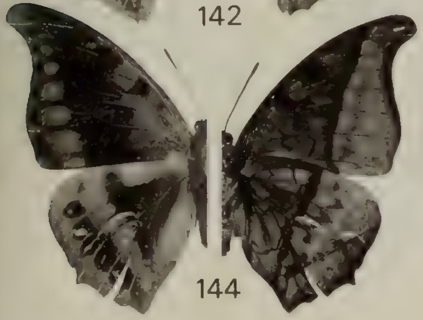
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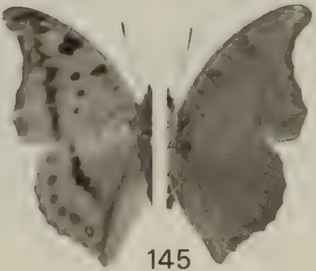
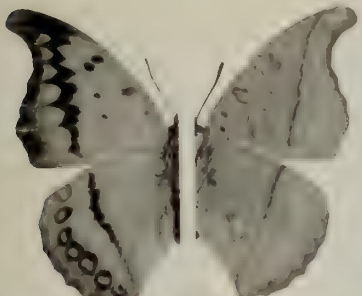

145

## PLATE 13

### *Charaxes*

Upper & undersides

| | |
|---|---|
| FIG. 146. | *nichetes leonius* Butler, ♀ (Malawi). |
| FIG. 147. | *nichetes leonius* Butler, cline to *pantherinus* (Zambia: Mwinilunga). |
| FIG. 148. | *nichetes pantherinus* Rousseau-Decelle, ♀ (Congo: Katanga, Kafakumba). Photos I. Grahame. |
| FIG. 149. | *zingha* Stoll, ♂ (Uganda). |
| FIGS 150 & 151. | *zingha* Stoll, ♀♀ (Uganda). |
| FIG. 152. | *candiope candiope* Godart, ♂ (Uganda: Bufumbo Forest). |
| FIG. 153. | *candiope candiope* Godart, ♂ (Kenya: Kitale). |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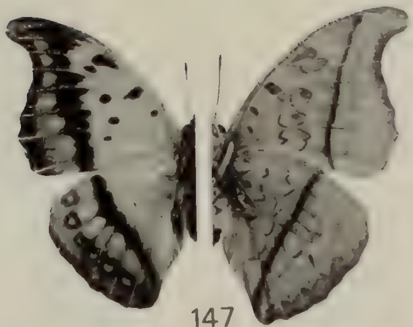
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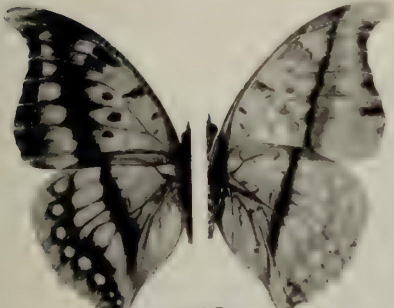
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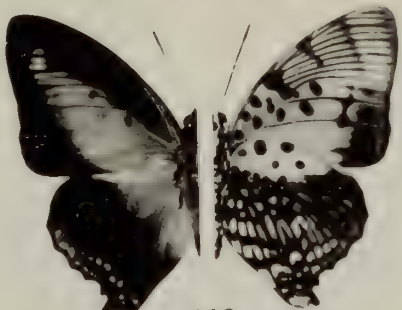
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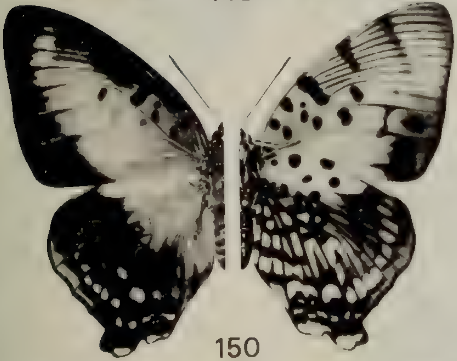
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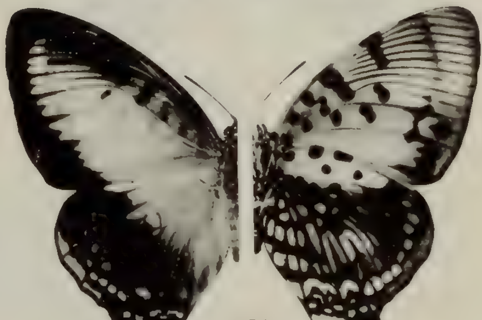
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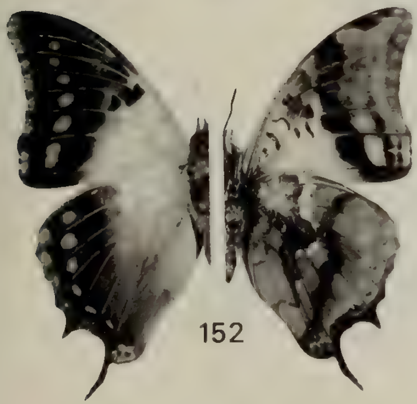
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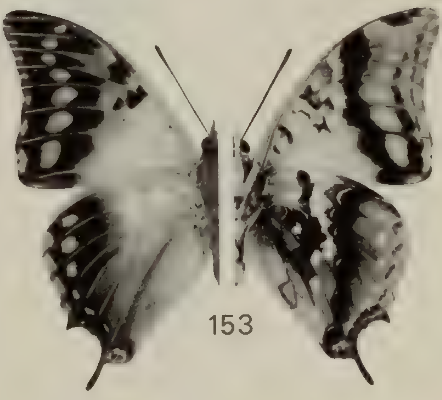
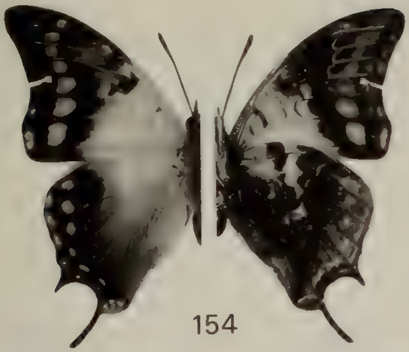

153

## PLATE 14

*Charaxes*

Upper & undersides

| | |
|---|---|
| Fig. 154. | *candiope candiope* Godart, ♂ (Kenya: Nairobi). |
| Figs 155–157. | *candiope candiope* Godart, ♀♀ (Kenya: Nairobi). |
| Fig. 158. | *candiope thomassius* Staudinger & Schatz, ♂ (São Thomé). |
| Fig. 159. | *candiope velox* Grant, ♂ (Socotra, Gulf of Aden). |
| Fig. 160. | *candiope velox* Grant, ♀ (Socotra, Gulf of Aden). |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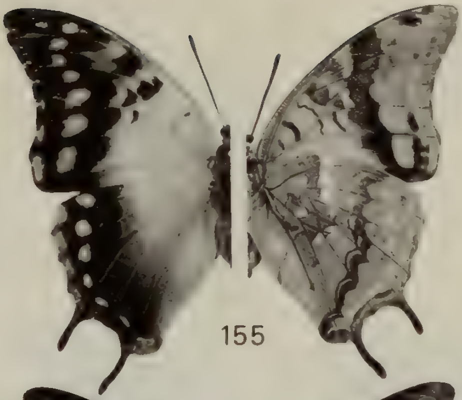
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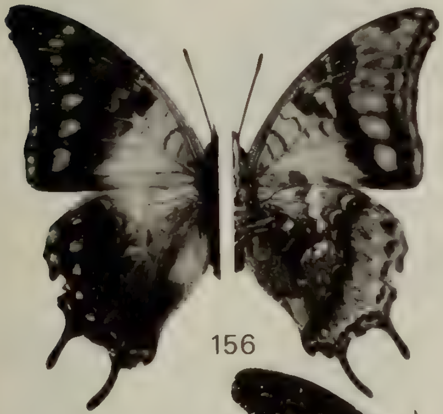
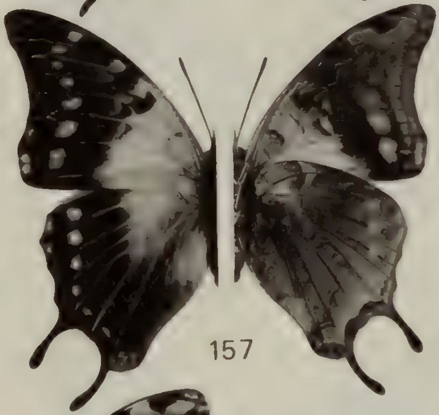

156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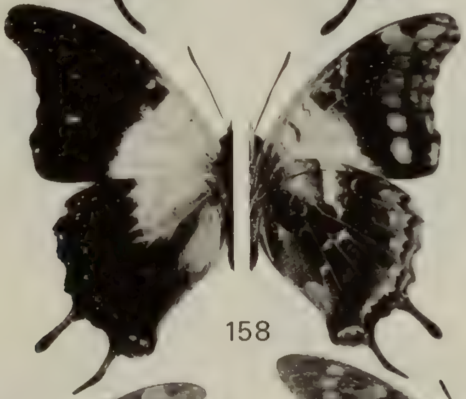
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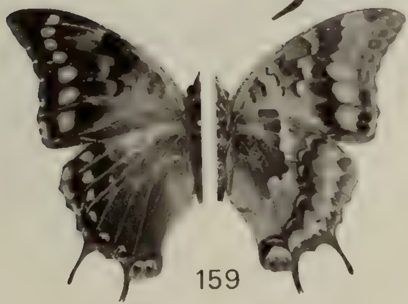
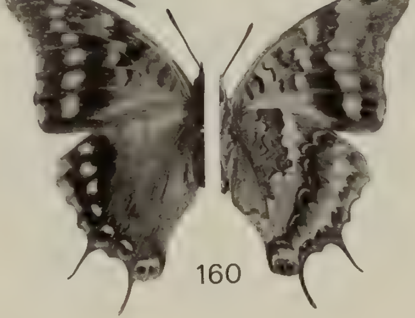

159

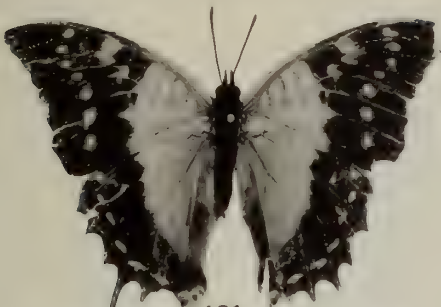

160

## PLATE 15

### *Charaxes*

Upper & undersides

| | |
|---|---|
| FIGS 161 & 162. | *cowani* Butler, ♀ Type (Madagascar). Photos B.M.(N.H.) Nos 51258–9. |
| FIG. 163. | *cowani* Butler, ♂ (Madagascar). |
| FIG. 164. | *cowani* Butler, ♀ (Madagascar: S. Betseleo) (*Hildebrandt*). Photos B.M. (N.H) Nos 51264–5. |
| FIGS 165 & 166. | *antamboulou* Lucas, ♂ ♂ (Madagascar). |
| FIGS 167 & 168. | *antamboulou* Lucus, ♀ ♀ (Madagascar). |



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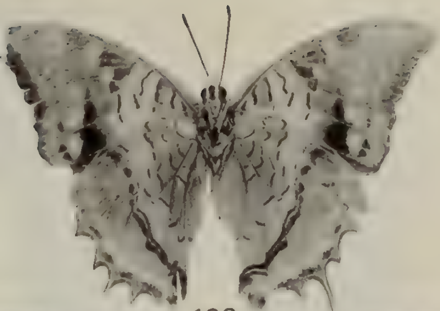

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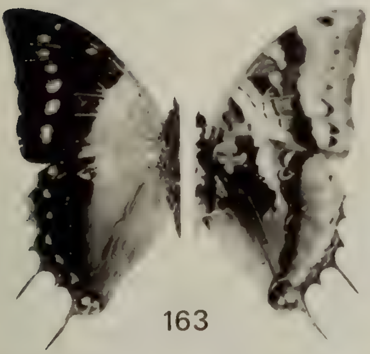

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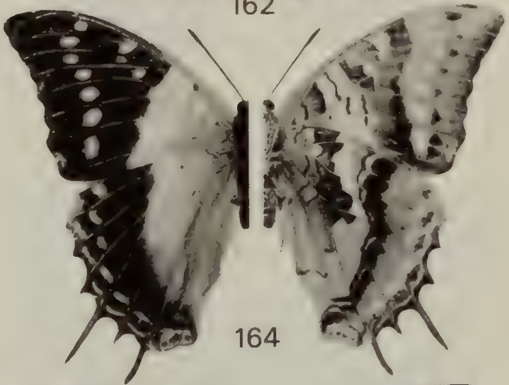

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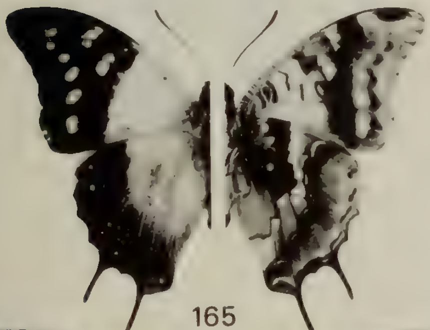

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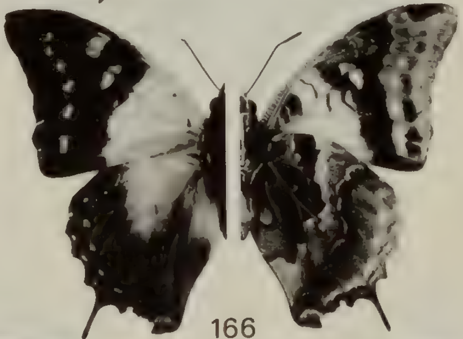

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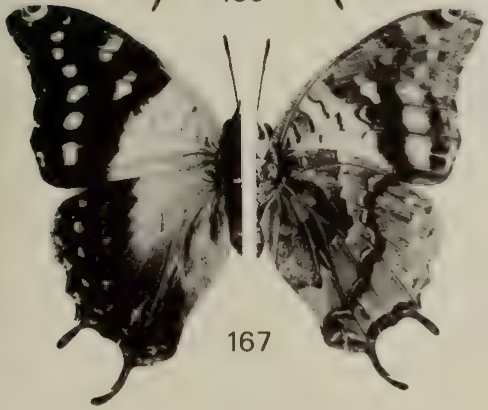
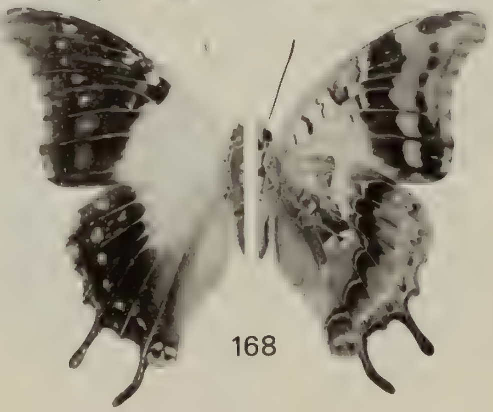


167



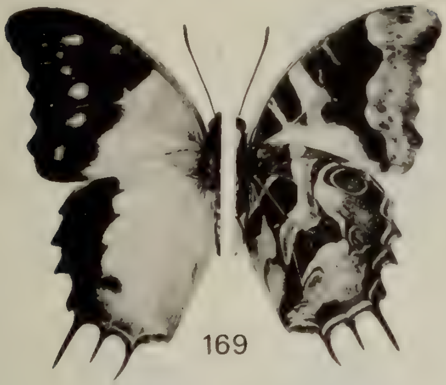
168

## PLATE 16

### *Charaxes*

Upper & undersides

Fig. 169. *analava* Ward, ♂ (Madagascar).
Fig. 170. *analava* Ward, ♀ (Madagascar).
Fig. 171. *phraortes* Doubleday, ♂ (Madagascar).
Fig. 172. *phraortes* Doubleday, ♀ (Madagascar, Diego Suarez) (*E. B. Perrot*). Photos B.M. (N.H.) Nos 51248–9.
Fig. 173. *andranodorus* Mabille, ♂ (Madagascar).
Fig. 174. *andranodorus* Mabille, ♀ (Madagascar).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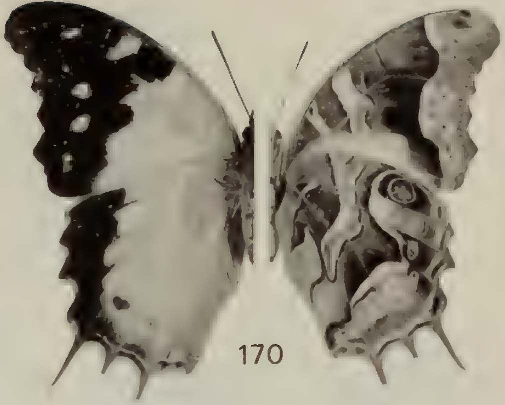
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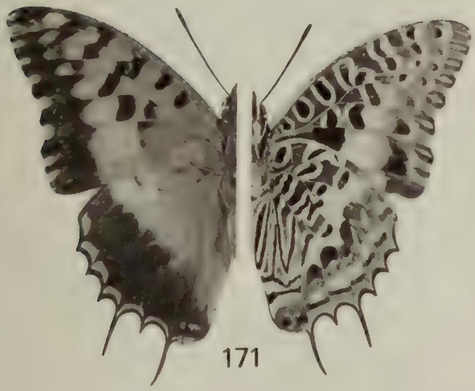
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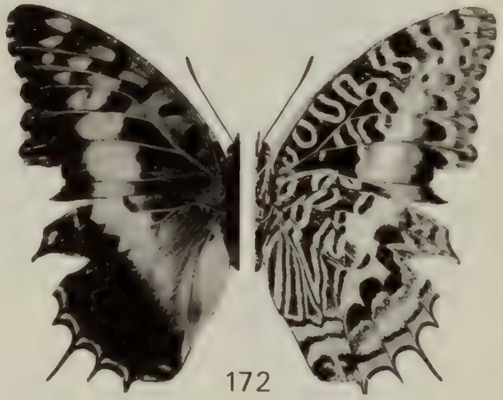
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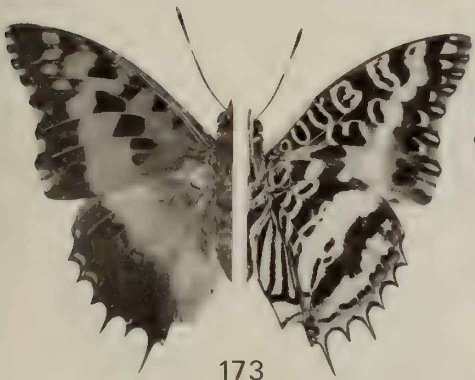
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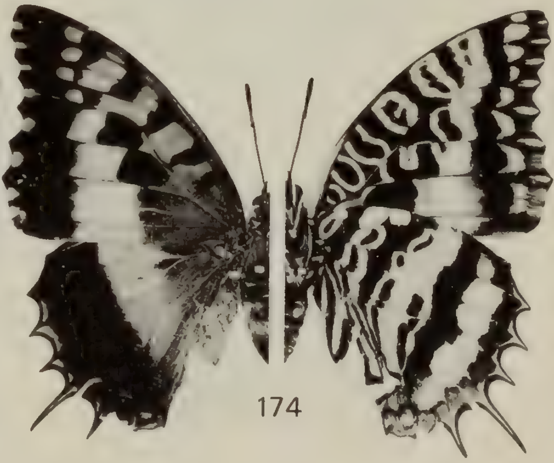
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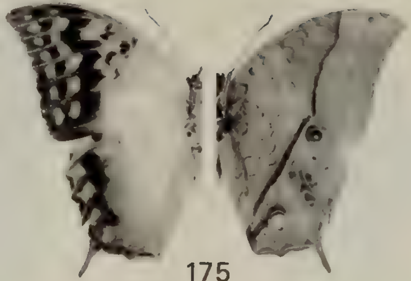
## PLATE 17

*Charaxes varanes* Cramer

Upper & undersides

FIG. 175. *varanes* Cramer, ♂ (Mozambique).
FIG. 176. *vologeses* Mabille, ♂ (Uganda: Metu Hills, W. Madi).
FIG. 177. *vologeses* Mabille, ♂ (Kenya: Ngong).
FIG. 178. *vologeses* Mabille, ♂ (Kenya: south-east of Lake Rudolf, Mt. Kulal).
FIG. 179. *vologeses* Mabille, ♂ (Kenya: north-east Mt Kenya, Meru).
FIG. 180. *vologeses* Mabille, ♀ (Kenya, Mt Kulal).
FIG. 181. *vologeses* Mabille, ♀ (Uganda: Jinja).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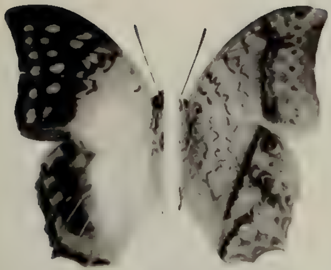
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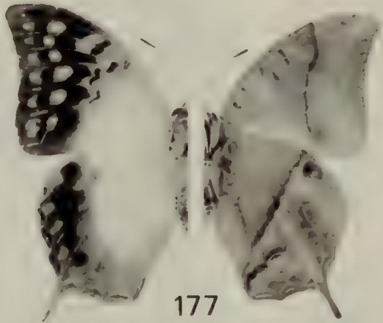
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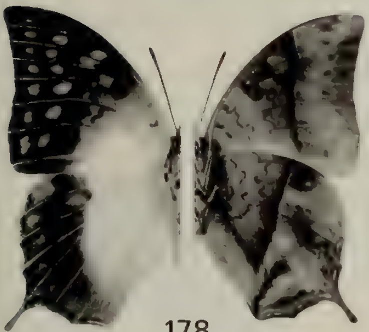
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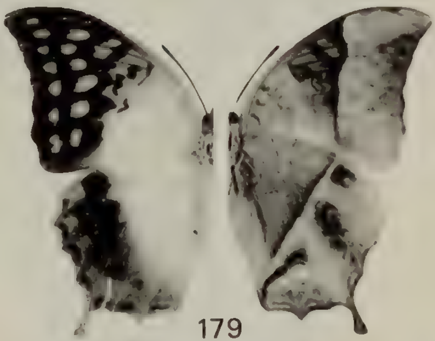
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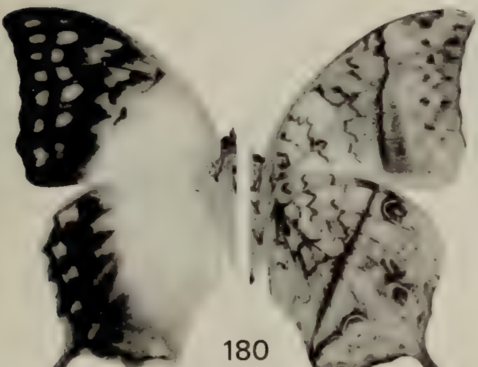
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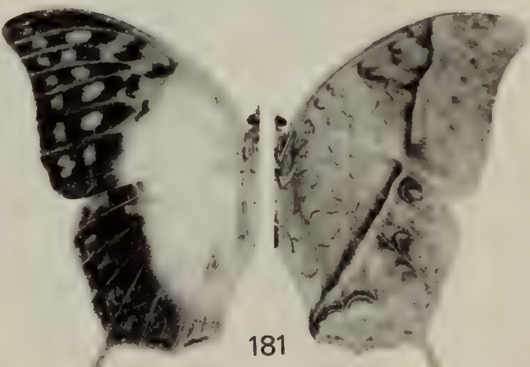
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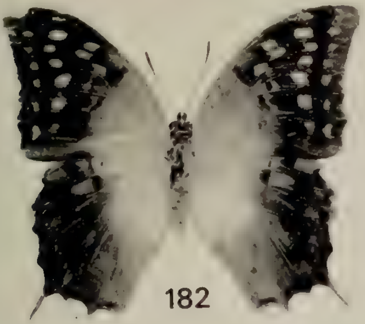
## PLATE 18

*Charaxes*

Upper & undersides

| | |
|---|---|
| Figs 182 & 183. | *varanes bertrami* Riley, ♂ Holotype (Southern Arabia: Quara Mts). Photos B.M.(N.H.) Nos 50104–5. |
| Fig. 184. | *varanes defulvata* Joicey & Talbot, ♂ Holotype (São Thomé: Gulf of Guinea) Photos B.M. (N.H.) Nos 50106–7. |
| Fig. 185. | *baumanni bamptoni* subsp. n., ♂ Holotype (Kenya: Northern Frontier district, Mt Kulal, 6200 ft, 6.iii.1972) (*I. Bampton*). |
| Fig. 186. | *baumanni bamptoni* subsp. n., ♀ Allotype (Kenya: Northern Frontier district, Mt Kulal, 6200 ft, 6.ii.1972) (*I. Bampton*). |
| Figs 187 & 188. | *martini* van Someren, ♀ Neallotype (Malawi: Mlanje, Milosa stream, 3000 ft. 17.x.1968) (*P. T. Martin*). |
| Fig. 189. | *lactitinctus ungemachi* Le Cerf, ♀ Allotype (Ethiopia: Youbdo). Photo M.N.H.N. Paris. No underside figured. |
| Fig. 190. | *lactitinctus ungemachi* Le Cerf, ♂ Holotype (Ethiopia: Youbdo). Photo M.N.H.N. Paris. No underside figured. |
| Fig. 191. | *lydiae* Holland, ♂ Neallotype (Congo: Moyen Congo, Kelle, Ndouba, x. 1963) (*T. H. E. Jackson*). Photos B.M.(N.H.) Nos 38843–4. |
| Fig. 192. | *lydiae* Holland, ♀ (Congo: Moyen Congo, Kelle, Ndouba, xi 1963) (*T. H. E. Jackson*). |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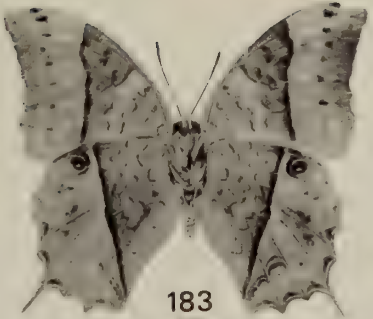
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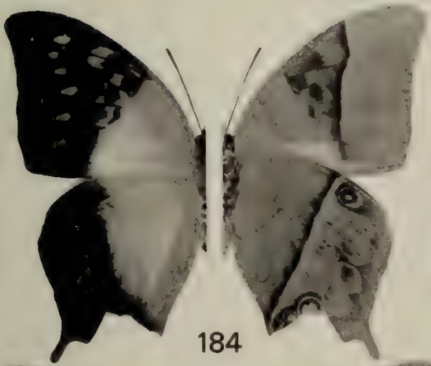
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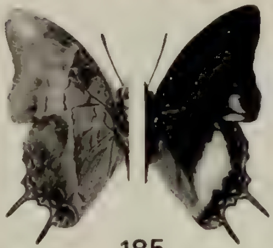
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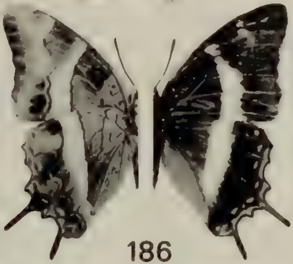
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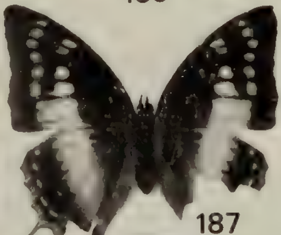
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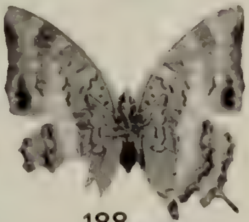
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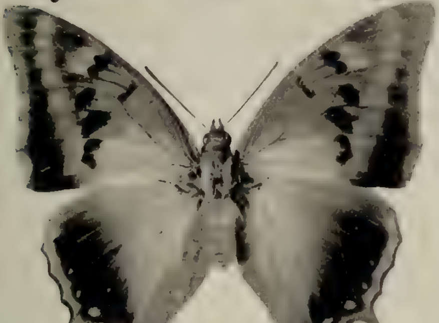
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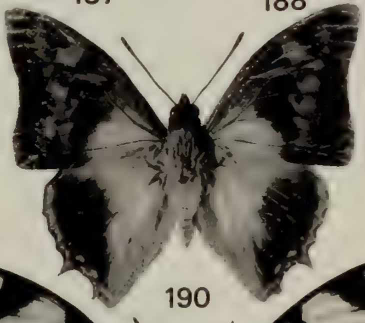
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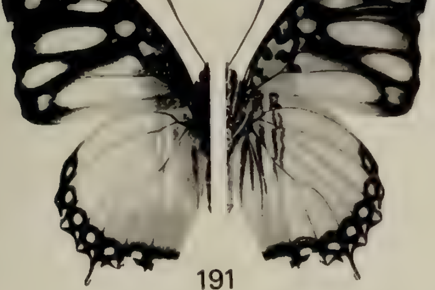
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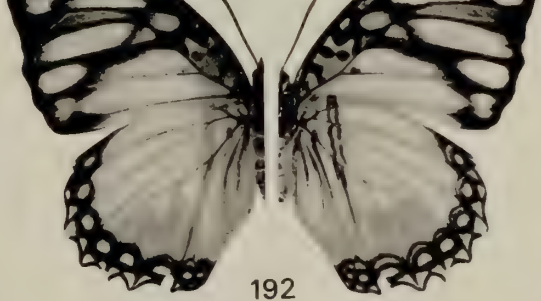
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